UNIVERSITY OF LJUBLJANA
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MASTER'S THESIS

THE IMPACT OF BLOCKCHAIN TECHNOLOGY ON BUSINESS MODELS IN SLOVENIAN COMPANIES

Ljubljana, November 2024 IVANA ANDONOVSKA

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LIST OF ABBREVIATIONS

BC – Blockchain
BCI – Blockchain Implementation
BCT – Blockchain Technology
BM – Business Model
BMC – Business Model Canvas
BMI – Business Model Innovation
CRM – Customer Relationship Management

DLT – Distributed Ledger Technology
DeFi - Decentralized Finance
ETH - Ethereum
PoW - Proof of Work
PoS - Proof of Stake
P2P - Peer-to-Peer

1 INTRODUCTION

The importance of a business model (BM) became significantly important with the rise of the internet and the development of the different kind of technology. New technologies have reshaped various industries and created low-cost rivals that are threatening the traditional incumbents. Moreover, new technologies disrupt existing and create new BMs. A BM has dozens of definitions proposed. For the purpose of this research, BM can be defined as "the rationale of how an organization creates, delivers and capture value" (Osterwalder & Pigneur, 2010, p14). In contrast with the traditional approach present BMs use a strategic management template called BM canvas, which gives an organization visualization of where the business is now and where it can be in the future (Joyce & Paquin, 2016).

Nowadays, many BMs rely on new and innovative technology, and one of the novel technology developments that has the potential to create a new BM is blockchain technology. Being an immensely powerful technology, blockchain can drastically transform BMs and revolutionize the economy. It has a big influence and potential to change multiple industries and disrupt traditional BMs (Morkunas; Paschen & Boon, 2018).

Even though the first idea of the concept that applies to blockchain technology (BCT) was introduced by Haber and Scott Stornetta (1991), the beginnings of BCT as we know it today, date to 2008. In the same year of the great financial industry crash, an anonymous person going by the pseudonym Sathoshi Nakamato, published a white paper introducing a cash payment protocol that enables people to establish trust and record transactions without a third party (Nakamoto, 2008). The general idea was to create a decentralized way of using money without being attached or waiting for permission from any institution (Trabucchi et al., 2020).

A decade later, Bitcoin together with other cryptocurrencies reached a significant success with a market capitalization of over $800 billion (Trabucchi et al., 2020). The technology that enables bitcoin and cryptocurrency is the blockchain technology, which characteristic of a decentralized ledger doesn't require a need of intermediary (Forsstrom, 2018). Distributed ledger enables transactions between two parties to be recorded in a verifiable and permanent way (Lakhani & Iansiti, 2017).

Therefore, blockchain creates a new way of organizing economic activities that can save time and reduce cost (Nowinski et al., 2017). The most important part of BCT is that the software can run in a secure and decentralized manner (Pierro, 2017). Being a peer-to-peer(P2P) network, blockchain is not controlled by a single party and enables numerous individuals to organize and coordinate common activities and interact directly in a secure manner without including a third party (Tapscott & Tapscott, 2016).

According to Primavera De Fillippi, BCT with its distributed system can transform the hierarchical organization into bottom-up cooperative governance. Hence, it can lead to a new way of how wealth will be distributed, and it will give people a chance to cooperate in the direction of creating common goods (Filipova, 2018). Therefore, BCT gives a chance to a new organizational structure that is less hierarchical, which means that people can coordinate themselves in a P2 manner (Filippi, 2020).

Lately, the most active research on blockchain applications take place in the fields of the financial industry, supply chain, two-sided markets, and social welfare (Weking et al., 2019). In the financial industry, direct transactions between two parties with no need for additional currency exchange fees can enable cost optimization, reduce the risk of fraud, and secure transactions without using a third trusted party (Sikonja, 2018). The second popular application of BCT is the supply chain (Ducrée et al,. 2020). The distributed ledger of blockchain gives availability to users of the system to identify and track the location of an item through the supply chain (O'Leary, 2017). Blockchain also has potential in public services and governmental applications, i.e. blockchain can enable digitalization of the voting system in a way of decreasing voter participation (Khan et al., 2018).

Another area that is changing, relates to smart contracts as blockchain is disrupting the existing "modus operandi" from preserving, verifying, and executing codes of smart contracts to issuing overstock cryptocurrency bonds with the prior approval of the regulatory body. Furthermore, BCT can make record-keeping simpler by ensuring transparency (Chowdhury, 2019). In addition, there is a significant number of opportunities to disrupt the BMs for the healthcare industry such as new ways for sharing patient data through different clinics and research institutes (Khan; Arshad & Khan, 2018). The potential of BCT has also been recognized by big corporations, such as Walmart, Nestle and Unilever, which have implemented BCT to track and control the whole supply chain process (Chowdhury, 2019).

BCT has the power to change the way how two-sided platform works. In two-sided platforms, there are a platform providers, such as Uber, Airbnb, or Blabla car, which enable transactions between two-sided parties that helps two sides reducing the cost of the transaction (Trabucchi et al,. 2020). BCT can challenge the traditional BM of two-sided platforms, where users of the decentralized network take charges of activates such as connecting the sides and assuring transactions between them (Beck & Müller-Bloch 2017).

However, BCT can be applied in every aspect of business and can introduce new or transform existing BMs in countries all over the world.

One of the countries that invests largely in BCT in recent years is Slovenia (Government of Slovenia, 2019). As a relatively small country, Slovenia has a fast-growing economy and BCT implementation is an important part of the national development strategy. In 2019

Slovenia launched national blockchain infrastructure SI-Chain which is helping the public and private sector to test existing or new blockchain applications (Government of Slovenia, 2019). Furthermore, the Slovenian government is preparing regulatory solutions for specific industries using BCT. Anyhow, while many Slovenian companies have already implemented BCT to support their BMs and are using it in their daily business, many more are still to follow. For these companies, the analysis of the impact that BCT has on BMs can be of great importance for their future businesses. Thus, in my master's thesis I focus on how BCT affects BMs in Slovenian companies.

The purpose of my master's thesis is to highlight the importance of BCT for companies and show how its implementation fosters new value creation and disrupts the current business models. To identify how BCT promotes innovative ways of how businesses produce and deliver their value, and analyze the impact it has on business models in Slovenian companies, my master's thesis consists of the following goals:

1. Align the theoretical framework of the BMs with BCT for a cohesive approach to be used in my master thesis.
2. Emphasize the impact of BCT on BMs.
3. Analyze the impact of BCT on Slovenian companies.
4. Identify benefits gained from blockchain implementation (BCI) affecting companie's business models.

The research methodology in my master's thesis consists of two parts: theoretical and practical. The theoretical part refers to the critical literature review, which is based on an up-to-date research database, scholarly papers, papers, books, conferences, and e-books. This part would give in-depth background knowledge of the idea for the thesis topic. The literature review summarizes the definitions, theories, and concepts that pave the path to the practical part of my master thesis.

As part of the research process, I also utilized generative AI tools to aid in terminology comprehension and exploration. These tools were employed to clarify complex terms and ensure consistency in language use throughout the thesis.

For the practical part, I researched the businesses in Slovenia, that disrupted their BMs by implementing blockchain technology. To understand and learn about the tackled area, I've conducted survey with relevant stakeholders from businesses operating in different industries in Slovenia. The questions are constructed in a way that helped me investigate how blockchain influence each segment of the BM. In addition, the interviews survey helped me discover the advantages and disadvantages of implementing BCT into daily business operations. Based on the insights from the survey, I have prepared a SWOT analysis highlighting the strengths, weaknesses opportunities, and threats of using BCT for creating new or disrupting existing BMs.

Finally, I synthesize the gained understandings from the theoretical and practical part of my master's thesis to discuss the potential impacts of BCT implementation onto BMs in Slovenian companies and provide the insights to be used by companies implementing the BCT into their future daily businesses.

2 BUSINESS MODEL

This chapter contains a an indepth review of BMs, detailing their evolution, various scholarly definitions, and the concept's importance in understanding how companies generate, deliver, and capture value. It explores the theoretical frameworks, distinguishing between static and transformational approaches, and discusses the dynamic nature of BMs in strategic decision-making. Finally, it introduces the Business Model Canvas (BMC), explains its nine building blocks and its practical applications in both business and academic contexts.

2.1 Definition of the Business Model

Understanding how businesses generate, deliver, and retain value has been made possible through the concept of a BM. The term "business model" has its conceptual roots in earlier management theories, but its widespread recognition dates to the late 1990s and early 2000s with the emergence of the digital economy (Hedman & Kalling, 2003).

The literature on BMs is abundant with research offering definitions, components, and classifications, all of which contribute to the understanding of what constitutes a BM (Lambert & Davidson, 2013). Unfortunately, there is a lack of consensus on a single widely accepted definition of a BM, despite the term being used extensively in academic and business-related discourses (Casadesus-Masanell & Ricart, 2011; Lambert & Davidson, 2013; DaSilva & Trkman, 2014; Ritter & Lettl, 2018). Nevertheless, there have been numerous academics that have tried to clarify the BM concept through the provision of their respective definitions.

The term BM first appeared in 1957 in an academic article which was focused on the development of business games for training purposes (Bellman et al., 1957). However, the term itself was only mentioned once, and Bellman et al. (1957) did not provide any context or definition for it. One of the earliest definitions available in the literature is from Timmers (1998), who describes the BM as comprising a framework for a product or service, the flow of information, advantages for business participants, and revenue sources. Alternatively, according to Magretta (2002), the BM can be understood narrative that illustrates the inner workings of an organization, emphasizing the customer's identity, values, and revenue stream. The core of the BM revolves around the stakeholder relationship it fosters and the strategic activities that are taken in the process of value creation. Therefore, the BM can be a description of the relationships and roles among the organization's allies, suppliers,

consumers, and customers that highlight the main financial, informational, and product flows as well as the main advantages for all parties involved (Weill & Vitale, 2002).

Additionally, some certain authors put more emphasis on the activities performed by organizations when discussing BMs. Zott & Amit (2010, p.16) describes the BS as a network of interconnected activities extending beyond the focal company and reaching its boundaries, facilitating the firm, along with its collaborators, to generate value and claim a portion of that value. Moreover, the BM encompasses the combination of activities undertaken by a company, encompassing their methods, timing, and resource allocation, customized to its industry, with the objective of creating high-value offerings (via either cost efficiency or product differentiation) and strategically positioning itself to capture value (Afuah, 2003, p.9).

Furthermore, from a managerial perspective the BM results from managerial decisions-whether intentional, spontaneous, or achieved – regarding a firm's products/services provided to other economic entities, the scope of its operations, and the rationale behind generating profits from these offerings and operations (Shi & Manning, 2009). In addition, a BM encapsulates a company's fundamental logic and strategic decisions aimed at generating and seizing value within a network of value exchange (Shafer et al., 2005).

Given that we took into consideration different BM definitions along with their respective insights about the components, functions, and strategic implications of BMs, it is evident that the topic is characterized by a definitional plurality. Furthermore, this suggests that the topic of BMs has been widely researched and analyzed from different perspectives (DaSilva & Trkman, 2014).

However, definitions are not always able to fully explain the concept of BMs, thus we need to consider the theory which has contributed to the conceptualization and utilization of BMs in various diverse contexts. In the next chapter we continue the discussion on BMs by focusing on BM theories that contribute to the further clarification and understanding to their multifaceted nature.

2.2 Theory of the Business Models

Since the first mentioning of the term BM in the 1950s till today there has been a wide range of research that is supported by a diverse range of theoretical frameworks scattered across various research domains. Demil and Lecocq (2010) distinguish between two main approaches to BMs: the static approach, which views BMs as a coherent blueprint, and the transformational approach, which focuses on change and innovation.

Subsequently, BMs have a dynamic nature – they evolve over time in response to internal and external environment changes (Hedman & Kalling, 2003; Morris et al., 2005). BMs

serve as effective tools for analyzing, executing and conveying strategic decisions, functioning separately from yet in harmony with corporate strategy. Additionally, from a managerial standpoint BMs can bring clarity in decision making, enabling better alignment of strategic goals and execution (Shafer et al., 2005).

While on the topic of decision making, Morris et al. (2005) proposed a framework that involves three distinct levels of decision making labeled as the 'foundation', 'proprietary', and 'rules' level. The foundation level considers the generic managerial decisions made, and it allows for comparisons and identification of comprehensive models. This level is characterized by six decision areas, and the authors provide six questions for each, which can be used by managers and entrepreneurs to underline their BMs. The questions are as follows: "How will the firm create value*?*", "For whom will the firm create value?", "What is the firm's internal source of advantage?", "How will the firm position itself in the marketplace? "How will the firm make money?", and "What are the entrepreneur's time, scope, and size ambitions?". After initially capturing the essence of the BM with the proposed framework, managers can progress to the proprietary level. This level can drive BM innovation, but it heavilz relies on their ability to develop unique approaches in their attempt to differentiate one or more of the six componenets. After organizations implement changes, they arrive at the rules level, where a fundamental set of guidelines and principles need to be set to ensure the success of the BM (Morris et al., 2005).

A historical and philosophical approach that contributes to the understanding of BMs is taken by Baden-Fuller and Morgan (2010), which state that BMs can simultaneously play three roles, namely as descriptive and classificatory tools, as instruments for scientific investigations, and as practical recipes for managers. In addition, they argue that the multifaceted nature of BMs explains their widespread use and the difficulty in comprehending their operational dynamics (Baden-Fuller & Morgan, 2010).

Furthermore, there are three crucial dimensions of BMs that need to be considered to grasp how firms create and capture value. Those include the *resource structure*, which is the fixed architecture of the company's organizational setup, production technology, and essential resources utilized to cater to customer needs, the *transactive structure*, which includes the mechanisms and processes through which a firm interacts with its external environment, and the *value structure*, which compromises the set of regulations, anticipations, and mechanisms dictating the firm's activities related to creating and capturing value (George & Bock, 2011).

Shi & Manning (2009) proposed a framework encompassing an assumption that BMs are made out of four fundamental and interconnected components or sub-models: the exchange model, the organizational model, the resource model, and the financial model. Essentially, the exchange model outlines the added value a firm offers to various market participants, including customers, suppliers, complementors, and competitors. The organizational model

includes the roles and responsibilities, activities, and business processes that enable the flow of products, information, and money to facilitate exchanges between the firm and its partners. The resource model covers the diverse resources the firm needs to mobilize and energize the organization. Finally, the financial model sets out the firm's objective functions that integrate the other three elements of the BM (Shi & Manning, 2009). Furthermore, BM can be seen as simplified systems of interconnected elements, similar to modular technology systems, which can be further broken down and analyzed to enable a more effective and efficient BM innovation and manipulation (Aversa et al., 2015).

Nevertheless, while articles published in the 2000s and 2010s were mainly focused on various managerial and organizational aspects of BMs and laid their foundation, it is also important to cover recent literature, especially those articles that connect BM with recent topics such as digitalization, innovation, and technology. Several authors have highlighted the topic of BM innovation (BMI) (Massa & Tucci, 2021, Caputo et al., 2021; Romanowski & Wieja, 2021; Ancillai et al., 2023). It is important to consider that BMs are not only a topic of innovation but can also serve as a source of innovation themselves. A key role of the BM in innovation is to facilitate the spread and adoption of new technologies and scientific discoveries by connecting them with the generation of economic output in markets (Massa & Tucci, 2021). One recent study by Caputo et al. (2021), highlighted the academic development of digitalization in regard to BMs, by conducting an analysis of published articles between 2010 and 2019 on the topic, and identified three main thematic clusters, namely strategic management, technological innovation, and digital transformation.

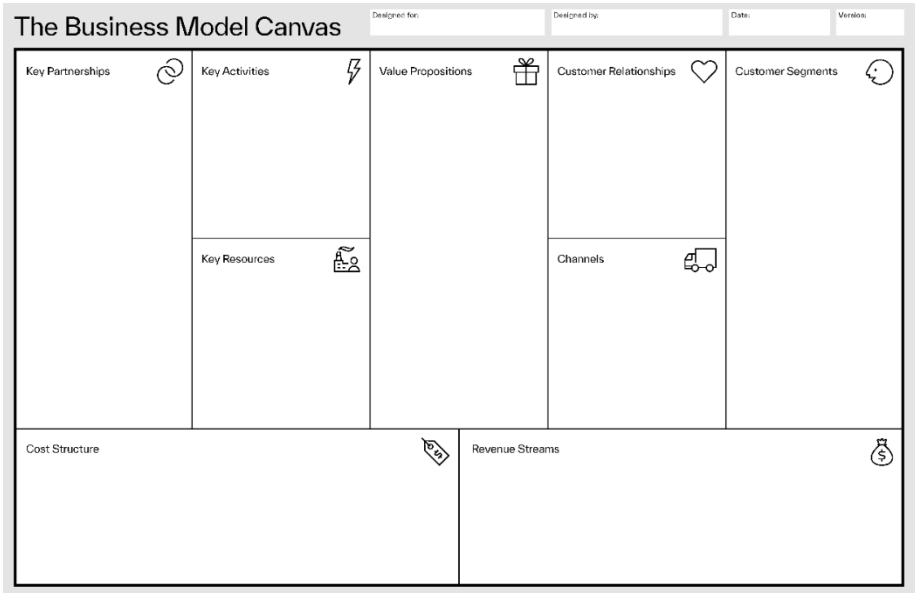
With the multifaceted nature of BM explored through various lenses - managerial, organizational, philosophical, and innovative - the complexity in these models becomes apparent. BMs morph and adapt in response to internal organizational changes or external market changes, such as digitalization and technology adoption. However, to be able to truly understand and operationalize BMs, we require more than just definitions and theoretical frameworks. Therefore, we need to consider a visual, standardized tool that will provide us with clarity regarding key BM components.

2.3 Business Model Canvas

BMC is a strategic management tool initially proposed by Osterwalder (2004) in his PhD work "The Business Model Ontology – A Proposition in a Design Science Approach" supervised by Yves Pigneur, later it became widely recognized through the book 'Business Model Generation' (Osterwalder & Pigneur, 2010a). The BMC provides a visual chart that outlines a company's or product's value proposition, infrastructure, customers, and financial aspects, that can help businesses and organizations to have a clear vision of what their BM consists of and to align their activities by highlighting potential trade-offs.

This tool is similar to a painter's canvas, pre-structured with nine blocks, and enables individuals and/or teams to illustrate new or existing BMs. The BMC, is most effective when printed on a large surface, allowing groups to collaboratively sketch and discuss BM components using Post-it® notes or board markers. It is an interactive tool that encourages understanding, discussion, creativity, and analysis (Osterwalder & Pigneur, 2010a).

Figure 1: The Business Model Canvas



Source: Osterwalder & Pigneur (2010b).

The respective 9 building blocks (as shown in Figure 1) of the BMC are as follows:

1. Customer Segments refer to the different groups of people or organizations that a business aims to reach and serve. The core of any BM are its profitable customers and no company can prosper or survive without them. Therefore, for companies to better meet the needs of customers, they can categorize them into segments based on common needs, behaviors, or other additional characteristics. Several customer segments can be targeted without any limit to their size. However, it is crucial for an organization to decide which segments to serve and which to disregard. With such a decision, a BM can be carefully crafted based on a thorough understanding of the specific needs of those customer segments (Osterwalder & Pigneur, 2010b).
2. Value Propositions outline the collection of products and services that deliver value to a specific customer segment. Value Propositions are important as they address a customer problem or fulfill a need and oftentimes are the reason behind why some customers choose one company over another. Each Value Proposition should include a selected set of products and/or services tailored to the requirements of a particular customer segment. In other words, the Value Proposition is a combination of benefits that a company offers to its customers. Some Value Propositions may be innovative and introduce new or

disruptive offerings, while others may be similar to existing market offerings but with additional features and attributes (Osterwalder & Pigneur, 2010b).

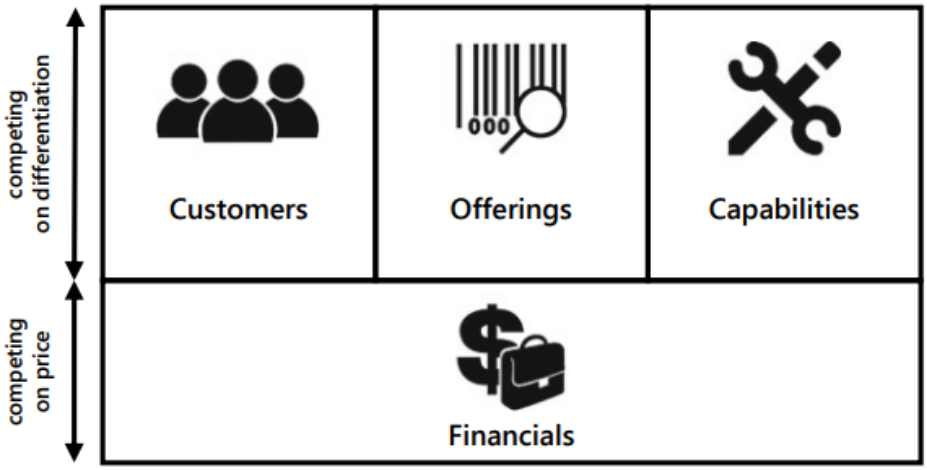
3. Channels explain the way that companies communicate and reach their customer segments to deliver a value proposition. This covers the channels of distribution, sales, and communication that a company utilizes to interact with its customers. Nevertheless, channels play a crucial role in the BM because they are points of contact for the customer and can have a significant influence on their experience with a company (Osterwalder & Pigneur, 2010b).
4. Customer Relationships describe the types of relationships that the companies have established with their customer segments. The type or rather the nature of the relationship that the company wishes to have with its customers needs to be defined and it can vary between being personal or automated. Depending on the company the goal behind every customer relationship can be motivated by various goals, including customer retention, customer acquisition, or boosting sales. Similar to value propositions, customer relationships can also have a significant impact on the overall customer experience. (Osterwalder & Pigneur, 2010b).
5. Revenue Streams denotes the cash a company earns from each Customer Segment (after subtracting costs to determine profits). While customers are the core of a BM, Revenue Streams are its lifeblood. A company must consider what value each Customer Segment is genuinely willing to pay for. Successfully addressing this question enables the creation of one or more Revenue Streams from each segment. These streams can have various pricing mechanisms, such as fixed list prices, bargaining, auctions, market-dependent pricing, volume-dependent pricing, or yield management. A BM can feature two types of Revenue Streams: transaction revenues from one-time customer payments, and recurring revenues from ongoing payments (Osterwalder & Pigneur, 2010b).
6. Key Resources present the assets that are necessary to support a BM. They are crucial for a BM to be able to create and offer a value proposition, access markets, maintain customer relationships, and generate revenues. There are different types of Key Resources and they completely depend on the nature of the specific BM. For instance, a microchip manufacturer needs capital-intensive production facilities, while a microchip designer places more emphasis on human resources. Thus, these resources can involve physical, financial, intellectual, or human assets, and they may be owned or leased by the company or obtained through strategic partnerships (Osterwalder & Pigneur, 2010b).
7. Key Activities include the necessary activities that companies must undertake to ensure the success of their BM. Along with key resources, they play a crucial role and can significantly influence other blocks in the BM. The type of activities that a company performs, as in the case of key resources, depends on the overall nature of the BM. (Osterwalder & Pigneur, 2010b).
8. Key Partnerships are needed to ensure that a BM is functional and they refer to the companies' network of suppliers and collaborators. The partnerships that are established can serve various purposes and have become integral parts of numerous BMs. The reason for setting in place such partnerships could be related to the enhancement of the BM,

access to resources, or risk mitigation. Partnerships can be further categorized into four main types: strategic alliances, coopetition, joint ventures, and buyer-supplier relationships. (Osterwalder & Pigneur, 2010b).

9. Cost Structure detail all costs necessary for sustaining a BM. It encompasses the most significant costs incurred while operating within a specific BM, including those associated with creating value, maintaining Customer Relationships, and generating revenue. Calculating these costs typically follows the identification of Key Resources, Key Activities, and Key Partnerships (Osterwalder & Pigneur, 2010b).

These nine foundational sections are also further divided into creative functions (Customer Segments, Customer Relationships, and Channels) on the right side and logistical functions (Key Resources, Key Activities, and Key Partnerships) on the left side, while the foundation represents financial components, including costs and revenues Partnerships (Osterwalder & Pigneur, 2010).

Figure 2: Lightweight Business Model Canvas



Source: Diderich (2019).

After its commercialized use for scientific research, teaching, and practical business purposes, the BMC has experienced some modifications over the past decade. Wit and Dresler (2021) through their empirical analysis of 231 unique templates argue that the diversity in BMC templates stems from individual and team efforts in problem-solving. The development of templates reflects the continuous evolution of BMs, which is shaped by external factors within the business ecosystem (Wit & Dresler, 2021). Diderich (2019, p.31) makes a distinction between two levels of abstraction of the BMC framework – the lightweight BM and the detailed BM (the one proposed by Osterwalder & Pigneur, 2010).

The lightweight BMC (Figure 2) is a streamlined adaptation of the traditional canvas, comprising just four sections: Customers, Offerings, Capabilities, and Financials. It's specifically tailored for executives and managers to articulate and organize information,

perspectives, and concepts about their company, competitors, and industry (Diderich, 2019, p.32).

3 BLOCKCHAIN TECHNOLOGY

This chapter explores the BCT in detail, beginning with an overview of its fundamental ideas. It tracks the evolution of BCT through its phases, highlighting advancements and the rise of diverse kinds of BCT networks.

The chapter also examines how BCT is being used in various industries to show both its revolutionary potential and the challenges associated with putting it into practice. Finally, it offers insights into the prospects and possibilities of technology, outlining expected developments, legal considerations, and ongoing research required to realise its full potential.

3.1 Definition of Blockchain Technology

BCT became known among the wider public after Bitcoin was launched in 2008 by Satoshi Nakamoto because it is the underlying foundational technology behind the digital currency (Nakamoto, 2008). However, Bitcoin only popularized BCT, making the two synonymous. Still, the technology was already present before Bitcoin and its earliest evolutionary stage can be traced back to the 1990s. The scientists Stuart Haber and Scott Stornetta wanted to invent a cryptographic solution for time-stamping digital documents to ensure they could not be misdated or tampered with. Therefore, they developed a system that would store time-stamped documents into a chain of blocks (Haber & Stornetta, 1991), and that is considered the beginning of the evolution of the BCT technology.

To further emphasize their importance regarding the earliest development stages of BC, Nakamoto (2008) referenced the research and work of Haber and Stornetta in their Bitcoin whitepaper "Bitcoin: A Peer-to-Peer Electronic Cash System".
It has to be acknowledged that Bitcoin and BCT are not the same thing. Bitcoin is the first major BCT innovation in the field of cryptographic currencies, while BCT itself is the underlying technology behind Bitcoin (Gupta, 2017; Monrat et al., 2019). Furthermore, Bitcoin is just the most popular example of a solution that uses BCT technology. After Bitcoin, research was mainly focused on BCT usage in cryptocurrencies, but some researchers strongly believed that BCT could be applied to other fields as well (Yli-Huumo et al., 2016). Monrat et al. (2019) were able to synthesize research about use cases with BCT and determined some of the domains that it can be applied to.

A BCT is a P2P network that consists of a series of blocks connected in a chain that records all confirmed transactions through a public ledger. When new blocks are appended to the chain it can continuously grow. The core technologies of BCT, namely the digital signatures,

cryptographic hashing, and distributed consensus algorithms contribute to the creation of a decentralized environment. This is exactly what makes BCT unique, it allows transactions to be processed in a decentralized fashion, which in return removes the need for any central authority or intermediaries to validate and authenticate them (Monrat et al., 2019).

BCT falls within a broader category of distributed ledger technologies (DLTs), therefore, it is a type of DLT with distinct characteristics and features. However, similarly to how Bitcoin and BCT are used interchangeably, BCT and DLT are oftentimes discussed together (Trump et al., 2018; Perdana et al., 2021). DLTs essentially function as decentralized databases that use cryptographic techniques to provide distributed authenticity. When data is entered and recorded on a DLT it is simultaneously duplicated across a network of nodes aka participants, each of whom holds a copy of the ledger. Compared to the traditional ledgers, where there is a single central server, in DLTs each node in the network, is independently responsible for updating the record on the ledger as well as validating the changes proposed by other nodes (Perdana et al., 2021). Therefore, it provides transparency in terms of the authenticity of the data that is being stored while on the other hand, it reduces the risk of malicious intervention by attackers.

Additonally, such distribution of control among participants creates an issue with BCT related to the trustless environment. Monrat et al. (2019) pointed out that the decentralized nature of BCT poses issues related to trust in the system. Thus, BCT relies on consensus mechanisms to ensure that nodes across the network are consistent and accurate when they record data, despite the absence of a central authority. In order words, a consensus mechanism is a set of actions followed by all or most nodes to reach an agreement on a proposed state or value. Without such consensus mechanisms in place, it is impossible to maintain the trustworthiness and integrity of the BCT. The two most commonly implemented consensus mechanisms are Proof of Work (PoW) and Proof of Stake (PoS):

- Proof of Work (PoW): The publishing process of new blocks is only made possible after validators aka miners solve a computationally challenging puzzle. The proof that each validator has completed their work is the correct answer to the puzzle. This consensus mechanism is designed to be challenging, but the verification procedure is very straightforward if the validator meets the specific criteria. Any suggested block that is not able to solve the puzzle is rejected, simplifying the process of validation (Yaga et al., 2018, p.19). Creating a valid PoW involves considerable trial and error, typically requiring numerous attempts before success. PoW can be seen as a random process with a low likelihood of producing a valid result (Buterin, 2013b).
- Proof of Stake (PoS): PoS relies on the notion that participants are more inclined to want the system to succeed and to want to subvert it if they have a greater stake in it, hence the name. Stake is typically the quantity of cryptocurrency that a participant of the BCT network has contributed to the system. This can be done by a variety of methods like locking it via a particular transaction type, sending it to a particular address or storing it in a specialized wallet application. Generally speaking, cryptocurrency cannot be spent

once taken. The stake a user has determines whether or not new blocks are published in the BCT. As a result, the probability that a participant of the BCT network will publish a new block depends on how much stake they have compared to the overall staked cryptocurrency on the BCT (Yaga et al., 2018, p.21). Participants in the PoS system must prove they are the owners of a specific quantity of money. In this system, a participant's mining power increases with the amount of currency they possess. This strategy discourages the abuse of miners' mining abilities by encouraging them to own a stake in the network (Buterin, 2013b).

Furthermore, cryptographic techniques are fundamental to BCT, ensuring the security and integrity of data. Public key cryptography allows participants to sign and verify transactions securely. Hash functions are used to link blocks in BCT, making it computationally infeasible to alter any part of the chain without detection (Ahmad et al., 2023). Cryptographic techniques are also crucial for implementing advanced BCT applications, including smart contracts, decentralized finance (DeFi), and secure voting systems, highlighting the interdisciplinary nature of cryptography and BCT (Lone & Naaz, 2020). Hashing involves using a cryptographic hash function on data to produce a nearly unique output, known as a message digest, for inputs of varying sizes such as files, text, or images. This allows individuals to independently verify the process by hashing the input data themselves and obtaining the same result. Even a minor change in the input will result in a completely different output. Key properties of a cryptographic hash function include being one-way (preimage resistant), meaning the input cannot be deduced from the output; it is also infeasible to find a different input that produces the same output. Additionally, the hash function is consistent, meaning the same data will always produce the same output, and it is collision-resistant, ensuring no two distinct inputs will generate the same output. The hash function is distinctive in that even a minimal modification to the input will result in a completely different hash output (Yaga et al., 2018, p.7).

BCT is renowned for its immutability, ensuring that once data is recorded, it cannot be altered or deleted. This is an essential aspect of the BCT, which ensures that it is secure and safe. Kim and Wang (2018) have proposed a metric called the "immutability measure" to quantify the difficulty of altering existing data in BCT systems. This metric takes into account various factors, such as the computational power and time needed for a successful attack, to ensure strong immutability across diverse BCT architectures. The security and integrity of BCT heavily rely on its immutability. Hofmann et al. (2017) emphasize that early standardization of BCT is vital to harness its full potential, ensuring that immutability features are implemented consistently and reliably across different applications.

A participant in a BCT network sends information to the network to execute a transaction. For instance, if person A intends to transfer an asset to person B, it must first be verified that A is the legal owner of the asset (Lewis et al., 2019). Once a *transaction* is validated and its authenticity confirmed, it is added to a *"block"* along with other new transactions. A block

consists of two main components: a block header and block data. The block header contains the metadata for the block, while the block data includes previous transactions submitted to the BCT network. The hashing process is used to link blocks together. When a new block is filled, it is connected to the previous block. Older blocks in the chain are more secure than newer ones. As mentioned before, the data is immutable, meaning once a block is added to the chain, the preceding data cannot be altered. This creates a chronological record of activities, and the chain continues to grow as new blocks are added (Yaga et al., 2018).

3.2 Evolution and Types of Blockchain Technology

For each technology known to mankind, we can trace its development and identify different generations that are distinguished by one or several significant advancements. These generations often signal dramatic changes and improvements, leading to the technology we know and rely on today. Each key step in the evolution builds on previous innovations, which in return reflects the dynamic nature and the continuous process of refinement and enhancement. Similarly, the development of BCT can be divided into distinct generations marked by significant advancements and innovations. Although BCT has existed for a much shorter period for example compared other technologies, it is expected that many important developments are still on the horizon.

Several scholars have categorized the evolution of BCT into three generations: BCT 1.0, BCT 2.0, and BCT 3.0 (Padmavathi & Rajagopalan, 2021; Kandil et al., 2021; Nanayakkara et al., 2021; Mukherjee & Pradhan, 2021). Therefore, to understand the evolution of BCT it is essential to examine and discuss each generation in detail, starting with BC 1.0, which is focused on digital currency.

The first generation of BCT – BCT 1.0, as previously mentioned, can be traced back to 2008 when an individual or group of individuals under the pseudonym Satoshi Nakamoto published a white paper titled "Bitcoin: A P2P Electronic Cash System." This paper introduced the concept of Bitcoin, a decentralized digital currency that operates without a central authority. The core innovation behind Bitcoin was the BCT. Bitcoin's BCT ensured the integrity and chronological order of transactions through a consensus mechanism PoW (Nakamoto, 2008).

While BCT has since been applied to a wide range of fields, it was originally designed with a specific focus on digital currencies and aimed at furthering the objectives of digital currencies in general. In its initial stages, BCT established the fundamental concept of a shared public ledger to support a cryptocurrency network. Satoshi's vision for BCT utilized 1-megabyte blocks to store information on Bitcoin transactions. These blocks are interconnected through a sophisticated cryptographic verification process, creating an unalterable chain. Even in its earliest form, BCT introduced many core features that persist today. In fact, Bitcoin's BCT has largely remained consistent with these original

implementations (Padmavathi & Rajagopalan, 2021). However, there is a significant limitation of BCT 1.0 and that is its inability to support concepts like smart contracts and its restriction to financial utilities, preventing its use in other application sectors (Panda et al., 2021, p.39).

As BCT technology evolved, developers recognized its potential to extend beyond merely documenting transactions. The founder of Ethereum, Vitalik Buterin, envisioned that BCT could also manage assets and trust agreements (Buterin, 2013a). This realization led to the creation of Ethereum, marking the second generation of BCT – BCT 2.0. Buterin played a key role in this advancement, expanding BCT's use beyond cryptographic currency and transactions. Ethereum's major innovation was the introduction of smart contracts. In traditional business, contracts are usually handled between two parties, often with additional entities overseeing the process. In contrast, smart contracts operate autonomously on a BCT. These contracts are activated by specific events, such as reaching a certain date or price target, and they manage themselves, accordingly, making necessary adjustments without external intervention (Cong & He, 2019; Wang et al., 2019). Smart contracts, as discussed by Nzuva (2019), offer several key benefits, including enhanced transaction credibility through a secure and decentralized system, and significant reductions in time and costs associated with traditional contracts. They automate and self-execute contractual terms, eliminating manual intervention and providing high security and tamper-proof agreements via BCT. Operating on a decentralized network, smart contracts reduce single points of failure and enhance contract enforcement resilience. They also ensure transparency, with all transactions and terms traceable on the BCT, providing clear audit trails and minimizing disputes (Nzuva, 2019).

However, smart contracts come with several issues. More specifically, security vulnerabilities and privacy concerns have been highlighted as the major challenges associated with smart contracts, which require advanced development of tools and platforms, as well as improved documentation and community support (Wang et al., 2019; Zheng et al., 2020; Zou et al., 2021). Furthermore, legal issues and regulatory uncertainties also pose a potential threat to the widespread adoption of such contracts (Gilcrest & Carvalho, 2018). In addition, due to the way that smart contracts operate (once established they are permanently recorded on the BCT) inflexibility rises as an issue, especially in highly volatile environments where the terms of a contract might require potential changes (Sklaroff, 2017). Another important innovation in this BCT generation is the Decentralized Apps (dApps) (Di Francesco Maesa & Mori, 2020). These are digital programs that operate on a BCT network of multiple computers rather than a single computer, putting them beyond the control of any central authority. This generation can facilitate inter-chain transactions using techniques like sharding. Sharding means that each node in the BCT holds only a portion of the data instead of the entire dataset. This distribution of data reduces the load and enhances system efficiency and security against intrusions (Besancon et al., 2022).

There is some debate over the classifications of BCT 2.0 and BCT 3.0. Some sources recognize BCT 2.0 by the introduction of smart contracts and dApps (Di Francesco Maesa & Mori, 2020), while others assert that BCT 2.0 is defined by the advent of smart contracts, and BCT 3.0 is distinguished by the proliferation of dApps (Mukherjee & Pradhan, 2021). For clarity, we will refer to only three generations of BCT, with a potential fourth on the horizon.

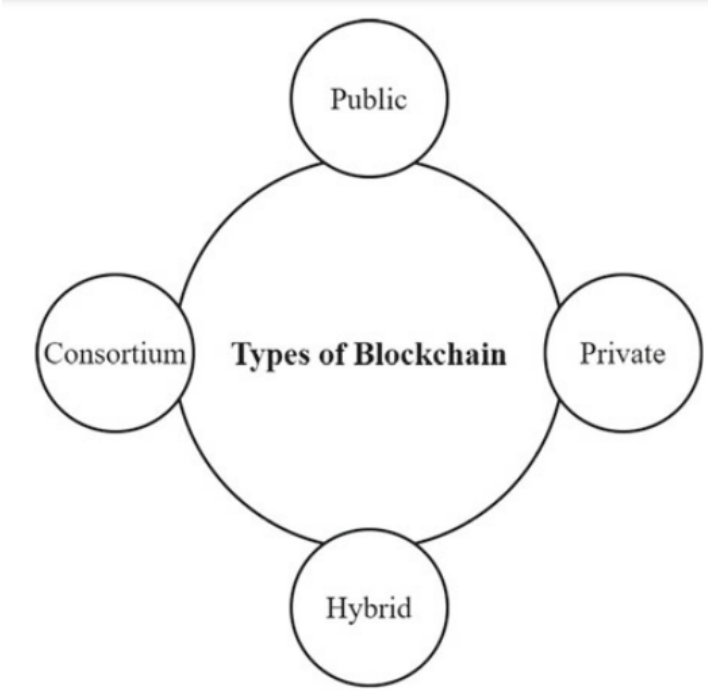
The main drawback of BCTs 1.0 and 2.0 is their lack of scalability. Primarily relying on PoW these systems can take hours to confirm transactions. The current era, known as BCT 3.0, prioritizes interoperability and scalability to overcome the limitations of earlier BCT generations. BCT 3.0 involves extending the attributes of BC's trustless decentralization—such as immutability, transparency, and the elimination of intermediaries—to other systems that are built on top of BCT (Di Francesco Maesa & Mori, 2020). It emphasizes cross-chain communication, enabling different BCT networks to share information and transfer assets seamlessly. This advancement allows users to interact across multiple BCs efficiently. Additionally, BCT 3.0 addresses the persistent challenge of scalability by exploring solutions like sharding and layer 2 scaling, which enhance the capacity of BCT networks and make them more adaptable to a global user base (Mukherjee & Pradhan, 2021).

The literature and online sources suggest the emergence of BCT 4.0, or the fourth generation of BCT (Mukherjee & Pradhan, 2021; Isan, 2024). However, this concept may be somewhat exaggerated. BCT 3.0 is often seen as a precursor to BCT 4.0, aiming to fully integrate BCT into commercial settings for developing and running applications. Previous generations of BCT have already demonstrated potential benefits for enterprises, including enhanced security, automatic record-keeping, immutability, and secure payment processing for bills, wages, and invoices. Nevertheless, there remains significant potential for advancements in terms of speed and the ease with which BCT innovations can be implemented. BCT 4.0 is anticipated to address these challenges and improve the user experience within the sector (Banafa, 2022; Isan, 2024). BCT 4.0 focuses on mainstream business applications, providing tools for secure, self-recording, and decentralized applications, which leaders can leverage for competitive advantage through streamlined processes, reduced costs, and enhanced security. Understanding BCT 4.0 aids in developing a long-term vision for organizational growth, attracting, and developing BCT talent, navigating regulatory compliance, and fostering a culture of innovation and adaptability (Lonergan, 2023).

Understanding the various forms of BCT that underpin these technological developments is crucial to realizing the full potential of BCT 4.0. As illustrated in Figure 3, BCT can be divided into four primary categories: consortium, public, private, and hybrid (Zhang et al., 2019; Arrifin & Subramanian, 2022; Taha & Alanezi, 2022). Because they each have unique benefits and features, different types can be used for different purposes.

Public BCTs are open networks where anyone can participate. These BCTs are decentralized, ensuring no single entity controls the network. Public BCTs rely on user consensus for transaction validation, making them secure and transparent. Examples of public BCTs include Bitcoin and Ethereum. These BCTs achieve decentralization by allowing anyone to join the network and participate in the consensus process, ensuring transparency and security. However, public BCTs are often criticized for their high energy consumption and susceptibility to attacks, as all nodes must validate transactions, which can lead to inefficiencies (Taha & Alanezi, 2022).

Figure 3: Types of Blockchain



Source: Panda et al. (2021).

Private BCTs, in contrast, restrict access to a single organization or a group of selected entities. These BCTs are not open to the public, and participation requires permission. Private BCTs are often used in enterprise settings where data privacy and control are paramount. They provide a higher level of privacy and efficiency compared to public BCTs because only authorized nodes can validate transactions, leading to faster processing times (Arrifin & Subramanian, 2022).

Consortium BCTs, also mentioned as federated BCTs, are partially decentralized and governed by a group of organizations rather than a single entity. These BCTs are designed to provide the benefits of both public and private BCTs, offering controlled access while maintaining decentralization to a certain extent. In a consortium BCT, pre-selected nodes from different organizations participate in the consensus process, which enhances trust and collaboration among the entities involved (Arrifin & Subramanian, 2022). This type of BCT

is particularly useful in sectors like banking, where multiple institutions need to work together while maintaining control over their data (Zhang et al., 2019).

Hybrid BCTs combine features of both public and private BCTs, aiming to leverage the advantages of both types. They allow for selective transparency and control, providing public access to certain data while keeping sensitive information private. This design makes hybrid BCTs versatile and suitable for a wide range of applications, including supply chain management and healthcare. For instance, a hybrid BCT can be used to conduct private auctions while publicly announcing the winning bids, ensuring transparency and privacy where needed (Bhanupriya et al., 2021).

From the introduction of Bitcoin in BCT 1.0 to the improvements in scalability and interoperability in BCT 3.0, the development of BCT demonstrates its expanding potential beyond virtual currencies. While BCT 3.0 focuses on resolving scaling issues, BCT 2.0 introduced Ethereum's smart contracts and decentralized applications. In the future, BCT 4.0 will most likely seek to improve efficiency and security by fully integrating BCT into mainstream industry. Comprehending the four main types of BCT - consortium, public, private, and hybrid offer their unique characteristics suitable for diverse uses. Each of them offers different advantages, from total openness to strict privacy constraints. We shall examine the varied uses and ramifications of BCT technology in a number of industries in the upcoming chapter.

3.3 Applications of Blockchain Technology

Recent years have seen a major increase in interest in BCT technology, which has resulted in a large body of literature examining its wide range of applications across numerous industries. Better security, efficiency, and transparency are promised by BCT's decentralised and tamper-proof ledger system, which spans financial services, real estate, healthcare, and supply chain management. In order to highlight the potential advantages, current difficulties, and future possibilities of BCT technology adoption and impact in these important domains, this review of the literature attempts to provide an overview of the state of the field.

The financial services sector is undergoing a transformation thanks to BCT technology, which is drastically cutting costs and the requirement for middlemen while improving efficiency, security, and transparency (Kayam, 2018). It provides a distributed and decentralised ledger system that guarantees safe, open, and unchangeable transactions, which makes it the perfect choice for a range of financial applications, including asset management, trade finance, and international money transfers (Su, 2023). For instance, BCT facilitates real-time sharing and verification of transaction data, which reduces trust issues and transaction disputes in trade financing (Su, 2023). Additionally, it enables direct cross-border transfers, thereby cutting down costs and processing times by eliminating intermediaries (Kayam, 2018). In securities trading, BCT enhances transparency and

efficiency by providing an immutable transaction record, which reduces costs and improves liquidity (Su, 2023). The technology also optimizes interbank clearing and settlement processes by creating a shared, accessible record for all banks, thus speeding up transactions and lowering associated costs (Beck et al., 2017). Smart contracts further improve contractual performance and transaction settlements by executing automatically under pre-set conditions, enhancing compliance and reducing fraud risks (Kayam, 2018). Despite these benefits, BCT faces challenges such as technical issues, regulatory hurdles, and privacy concerns, which require collaborative efforts between stakeholders and regulators to develop standardized protocols and frameworks (Zhang, 2020). The future of BCT in finance is promising, with ongoing research focusing on scalability, security, and interoperability, indicating significant potential for further transforming financial services (Beck et al., 2017; Su, 2023).

Additionally, BCT has become a game changer in the supply chain management. There are several factors that affect the adoption of BCT in supply chain management and organizations need to be aware of them if they want to carry a successful deployment. Supply chain managers' behavioural intentions are influenced by perceived usefulness and ease of use, which have a substantial impact on BCT acceptance. The technology's perceived value is increased by its capacity to streamline processes and simplify inventory financing. Since the decentralised structure of BCT increases transparency and decreases the need for intermediaries, it is important to build trust across organisations. Widespread adoption of BCT depends on resolving trust-related concerns. Although the transparency of BCT's data can improve effiency and trust, it also creates questions around data confidentiality, therefore a balance between the two is necessary for effective policy execution. Particularly, if the advantages do not exdeed these difficulties, the expense and complexity of adopting BCT technology, which includes substantial upfront expenses and the requirement for technical know-how can pose as a huge entry barrier (Alsmadi et al., 2023).

Kouhizadeh et al. (2021) analyzed input from practitiones and academics and identified three prominent barrier categories related to BCT adoption from a technological, organizational and environmental/supply chain context. Their analysis shows that adressing technological issues related to BCT adoption, as well as getting full support from external actors (industries, governments and partners) are strongly related to minimizing supply chain barriers. Accoring to Min (2019), the three most urgent challenges of BCT adoption are related to government regulations, interperability, and scalability among other. In addition, Saberi et al. (2018) states that the obstacles faced with the implementation of BCT in supply chains can be seen as a multifaceted complex issue, since the effects of adoption extend to impact not supply chain partners, but also their employees and stakeholders. Furthermore, they argue that the immaturity of BCT technology is the major contributing factor to many of the technological challenges that organizations face in BCT adoption (Saberi et al., 2018).

The most common frauds in the healthcare sector include the theft of confidential patient data and the manipulation of patients into false situations or cases, the fraudulent filing of false insurance claims worth billions of dollars for fictitious procedures, lab tests, surgeries, and other services, and the forging and counterfeiting of drugs from pharmacies and other sources (Vyas et al., 2020). BCT in the healthcare sector offers patients complete flexibility in safeguarding their records by supplying evidence of each task or movement, in other words, it makes sure that the health records are not tampered with. Additionally, it gives patients peace of mind that only they and the people they provide access to would be able to view their medical records and history. This secure method prevents any other third party from accessing or gathering any information from their data. Since BC relies on a decentralized database system, if they try to do so, they will be discovered (Vyas et al., 2020).

Furthermore, BCT facilitates interoperability between various healthcare systems, allowing seamless sharing of patient data across different platforms and providers. This capability is crucial in improving the efficiency and accuracy of medical care, as demonstrated by the pilot project from the United States 'Blockchain for Hospitals', which uses Ethereum BCT technology to create a shared infrastructure for real-time access to patient records between different medical institutions (Dimitrov, 2019). Additionally, a study (Attaran, 2020) came to the conclusion that BCT could be utilized to safely coordinate and compile data from various medical providers, enhance patient involvement, support the availability of patient data, enable direct and secure communication between healthcare professionals and patients, and promote family health management.

However, despite these benefits, research has pointed out several challenges with BCT implementation. From a more technical complexity standpoint, Mazlan et al. (2020) identified five main concerns with BCT, namely block size, enormous data volumes, transactions, node counts, and protocols, proposing solutions that focus mainly on the redesign of the BCT to tackle these challenges. On the other hand, another significant issue with BCT adoption in the healthcare sector comes from the complex legal regulations imposed by governments. Many regulatory bodies around the world have enforced laws, such as the General Data Protection Regulation (GDPR) in the EU and the Health Information Technology for Economic and Clinical Health (HITECH) in the USA, to make sure that healthcare providers handle patient data in a secure and private manner. Regulations mandate that patient data be kept confidential and made available to the owners upon request, as well as to third parties with consent, in addition to making sure that all necessary security precautions are followed anytime the data is shared, transmitted, or stored (Arbabi et al., 2023, p.389). Additionally, BCT might be impractical if patients find themselves in a critical health situation, for instance in the case of a heart attack or unconsciousness, where medical practitioners need immediate access to medical records (McGhin et al., 2019).

Saari et al. (2022) carried a systematic overview of the conceptual and theoretical literature of BCT in the real estate sector, classifying the benefits and challenges of BCT into four broader categories – real estate management, land administration, tokenization, and transactions. BCT can potentially address several challenges in the real estate industry, including fraud and corruption, excessive costs, nontransparrency, trust concerns and inefficiencies (Saari et al., 2022). The transaction process in real estate is carried out by multiple parties who share oftentimes non-digitized documents containing property information among each other, which makes the overall process unstructured and complex. BCT applications can help improve the process by providing digital records of physical and contractual information that can be encrypted and logged on the chain. However, the issue that the real estate sector faces in implementing a BCT infrastructure is the lack of data standardization (Wouda & Opdenakker, 2019). Garcia-Teruel (2020), in their attempt to explore the opportunities and challenges of BCT involvement in the real estate sector, identified three intermediaries that carry out the real estate conveyancing in the EU, as well as three common real estate procedures. In addition, they argue that one of the most crucial problems that needs to be resolved if BCT is used for real estate transactions is verification of the identity of the parties involved, which is a subject of public control. This might be resolved by simply establishing an official BCT protocol that requires the parties' IDs among other things. It could also have the ability to be connected to other national BCT to facilitate cross-border transactions (Garcia-Teruel, 2020).

The literature covering BCT implementation in various sectors showed the potential of the technology and its power to resolve some of the already existing issues that industries have been facing. However, it is evident that even despite its promising benefits, there are some challenges that BCT itself imposes that need to be addressed if organizations and governments decide to consider its widespread adoption.

Generally speaking, it seems that BCT is faced with two major challenges – technical and regulatory. In many aspects, BCT is still evolving and its technical limitations are being widely discussed by both academics and practitioners who are striving to provide solutions, which means in the upcoming years we can expect that BCT 4.0 could come to life. Consequently, some of the technical issues are also directly connected to the legal requirements imposed by governments. Nevertheless, it is crucial for regulatory bodies to be actively involved in the regulation of BCT, especially in sectors such as healthcare and real estate, where the downfalls of the technology could potentially harm citizens.

3.4 Future Outlooks of Blockchain Technology Implementation and Potential

Even though the technology is still in its early phases of development, BCT has become a sizable market on its own due to the potential of the technology and the strong business interest in its capabilities. The rising adoption rates in several industries and the significant investments made in BCT technology development are the main drivers of this expansion.

It is anticipated that investment levels would also increase, with venture capital funding for firms in BCT rising sharply.

A new financial system based mostly on P2P interactions and little to no traditional intermediation could be realised through Decentralised Finance (DeFi), made possible by BCT (Grassi et al., 2022). Gramlich et al. (2023) proposed a consolidated definition of DeFi based on a systematic literature conducted on previous publications: "DeFi is a decentralized financial system that enables financial services and instruments to be offered and used without the need for intermediaries as the system is based on public blockchains and smart contracts". The development of DeFi during the past several years can be interpreted as either a paradigm shift in the way financial services is provided or as the continuation of an ongoing trend in which new technology is replacing financial intermediaries as part of the fintech era (Aquilina et al., 2024).

Moreover, DeFi presents some serious obstacles for law regulators. The rules guiding DeFi must be integrated in the system for it to function in its fullest form. This is the perfect chance for governments to invest in RegTech and potentially use technology to create more efficient markets. In addition, legislation needs to change to meet the demands of DeFi (Zetzsche et al., 2020). Decentralization ensures that no one company may have an excessive amount of power or monopoly, but it also opens up new avenues for financial intermediation. DeFi has, nevertheless, inhertited concerns from its underlying technologies that may inadvertently encourage criminal activity and impair the regulatory capabilities of the government (Gramlich et al., 2023). As of June 21, 2024, the leader in the DeFi BCT market is Ethereum holding 61.2% of the market, followed by Tron which holds only 8.2% of the market (De Best, 2024).

Another recent discussion that relates to BCT is Web3, where many of the current parties involved in data governance will be disintermediated, setting the foundation for the next generation of the web. Web3 data will be store on BCTs, in numerous copies, and on a P2P network as opposed to the present server-client model (Park et al., 2023). From a consumer perspective, Web3's value proposition is evident. Instead of the existing centralised monetisation structure that adds to the financial riches of platform shareholders, several suggested versions of Web3 would reward users with native tokens with every tweet, post, or video. These tokens end up becoming Web3's fundamental unit. Despite sharing characteristics with digital currencies, these tokens can grant holders particular rights to vote, ownership stakes, or means to profit. Put otherwise, anybody can benefit from their data on Web 3. Tokens can be fractions of a Picasso painting, gold, diamonds, or access to assets (Voshmgir, 2020, p. 1). The transition from the current version of the web to Web3 also comes with on-going challenges. Namely, Web3’s backward compatibility is necessary to prevent ponetial effects on current applications and services, and its forward compatibility is crucial for future upgrades and application evolution. In addition, Web3 along with its

technology architecture and operations bring along problems related to its widespread deployment and management (Liu et al., 2023).

The process of removing confidential information from corporate systems, swapping it out for a secure token, and keeping the original data secured in a cloud vault is known as tokenization. By dividing a scarce asset into smaller portions, tokenisation technology allows small investors to invest in these assets by obtaining tokenised certificates, which are decrypted with appropriate key (Avci & Erzurumlu, 2023). Tokenization in real estate is a topic that is widely discussed in the literature, since it has the potential to enable investments coming from people that are willing to invest modest sums of money in real estate assets (Baum, 2021).

Non-fungable tokens (NFTs) first appeared in 2014 and in the recent years grew into popularity (Mulligan et al., 2023). Particularly, the peak of the NFTs was in 2021, when Beeple's First 1000 Days digital art was sold for a value of 69 million dollars (Statista Research Department, 2024b). An NFT is intended to be nonfungible, in contrast to cryptocurrencies like Bitcoin and Ether, which are fungable – they can be used interchangeably with one another. Since NFTs cannot be traded or substited one for the other since they are unique. Scarcity and uniqueness can consequently be used to determine NFTs (Mulligan et al., 2023). For instance, Karim et al. (2022) in their research reported that against DeFis and cryptocurrencies, NFTs showed a stronger potential for diversification for investment into BCT markets.

4 BLOCKCHAIN IMPACT ON BUSINESS MODEL

In this chapter, the impact of BCT on BMs is analyzed by considering the 9 distinct blocks of the BMC. The analysis considers each of the components seperately and it relies on real-life use cases, literature, and speculation to highlight the all the various aspects in which BCT can transform and enhance the traditional BMs and the value propositions they strive to deliver.

4.1 Blockchain and Customer Segments and Customer Relationship

Among BMC's nine building blocks, two crucial elements are Customer Segments and Customer Relationships. Customer Segments identify the distinct groups of people or organizations a business aims to reach and serve, essential for tailoring offerings to meet specific needs effectively. Customer Relationships, on the other hand, define the types of interactions a company establishes with each customer segment, aiming to enhance customer acquisition, retention, and overall satisfaction (Osterwalder & Pigneur, 2010b). In the continuation of this sub-chapter, we will focus on these two blocks to explore how BCT impacts them.

The implementation of BCT within firms can enable value control by monitoring the utilization of services and products to assess quality levels and identify customer preferences, allowing for tailored offerings (Beck & Müller-Bloch, 2017). In this context, BCT emerges as a transformative tool, providing enhanced trust, transparency, privacy protection, security in digital marketing, and opportunities for innovative loyalty programs. It achieves a new level of transparency by allowing customers to access relevant information on a distributed ledger, ensuring they are not burdened with excessive data. BCT is unique in enabling the creation of data marketplaces, where individuals maintain control over their personal data and can even monetize its usage (Upadhyay, 2024). Furthermore, direct interactions between customers and firms, without intermediaries, enhance customer trust in companies, leading to a positive impact on the customer (Kumar et al., 2021). Additionally, BCT unlocks previously unreachable market segments, providing businesses the chance to cater to niche, diverse, and broad markets alike (Morkunas et al., 2019).

BCT's distinctive value proposition is its capacity to address specific customer needs, especially regarding privacy, while promoting the creation of innovative products and services that attract new customer demographics. For example, Everest uses a private Ethereum-based protocol to reach developing countries in Africa, Asia, and South America, focusing on the 2 billion people who lack access to financial services. By providing a decentralized ledger that incorporates payment solutions, a multicurrency wallet, and a biometric identity system, Everest meets the needs for microfinance transactions, land claims, and medical records in these areas (Upadhyay, 2024).

Moreover, a study exploring the integration of BCT in the banking sector highlights its positive impact on customers' financial well-being, providing valuable insights for financial institutions, policymakers, and academics. This research reveals that BCT features such as efficiency, security, and regulatory compliance significantly enhance perceived financial well-being among banking customers. It also underscores the importance of perceived information transparency as a mediator between these BCT features and financial well-being. By leveraging BCT, financial institutions can improve transparency and trust, ultimately benefiting customers' financial health (Yang et al., 2024).
A notable example of BCT's potential is demonstrated by the Swedish government's land registry authority, Lantmäteriet. By adopting ChromaWay's BCT, Lantmäteriet has significantly improved the efficiency and transparency of real estate transactions in Sweden. The technology records each step of a transaction, making it accessible to relevant parties such as bank representatives and real estate agents, ensuring secure and up-to-date information. This system not only enhances the continuity and reliability of the process but also increases security and confidence among citizens. Lantmäteriet's successful trial of this BCT-based system has established a single, reliable source of truth, boosting the overall efficiency and security of land transactions (Proskurovska & Dörry, 2022).

BCT ensures high levels of data security and privacy through encryption and decentralized data storage, which minimizes the risk of data breaches and unauthorized access. This secure environment enhances customer trust and willingness to share data, further improving segmentation efforts (Giang & Tam, 2023).

For example, Civic is a provider of personal identity verification services that leverages advanced cryptography, BCT, and smart contracts to create secure, cost-effective, and on-demand identity verification solutions. Civic's goal is to establish a safe and fair future by offering a sustainable identity solution for any application. Civic's decentralized identity verification ecosystem, known as Identity, aims to connect users, requesters, and validators on a global scale. After a user's personal information is verified using Identity, they can utilize this verification across various platforms without needing to re-verify their identities. This ecosystem offers customers enhanced security and privacy, convenience, and cost savings. Customers are incentivized with Civic tokens, earned for participating in the ecosystem, which can also be used to purchase services such as background checks and dark web monitoring. This system ensures increased trust and global flexibility, making identity management more secure, efficient, and user-friendly

4.2 Blockchain and Value Proposition

The Value Proposition in the BMC describes the collection of products and services that deliver value to a specific customer segment. It is the reason customers prefer one company over another, as it addresses a customer problem or meets a need. Each Value Proposition comprises a set of products and/or services tailored to the requirements of a particular customer segment, essentially combining the benefits a company offers its customers. Some Value Propositions are innovative, introducing new or disruptive offerings, while others enhance existing market offerings with additional features and attributes (Osterwalder & Pigneur, 2010b). BCT can impact the Value Proposition segment of the BMC in various ways. To better understand this, we will examine real-life company use cases and discuss the benefits they have provided to their customers.

BCT's decentralized and cryptographic features ensure that data is securely recorded and cannot be altered once added to the BCT, providing an immutable record. This immutability significantly enhances security, making transactions and data storage more reliable and trustworthy. In this context, BCT can enhance security and trustworthiness among customers, thus we can exemplify this through the solution that the company Everledger provides. Everledger uses BCT to create a permanent digital record of diamonds and other high-value assets. From mining to retail, using BCT, the journey of the diamonds is permanently recorded on the ledger and therefore customers can have an unalterable record that verifies the diamond’s authenticity and ethical sourcing. Diamonds fall within the category of luxury goods market where such a level of transparency and security is crucial for proof of autheniticity since customers want to avoid being in possession of conflict

diamonds. Furthermore, Everledger offers solutions that can provide concrete and documented proof for compliance claims, not only by tracing the origin of products but also by providing evidence of progress toward environmental goals, investment in corporate social responsibility, and adherence to legal requirements, among others (Everledger, 2022). By offering this assurance, Everledger enhances the value proposition for consumers, building trust and confidence in their purchases and business practices.

As mentioned before, BCT provides a transparent and unalterable record of transactions and product histories, which is particularly valuable in supply chains. The transparency provided by BCT solutions can allow for fraud being avoided and quality control ensurance since customers and businesses can follow a product's exact path from its point of origin to its destination. Food waste, concerns over product safety and quality, a deteoriation in consumer confidence and brand reputation, and difficulties monitoring the origins of materials and handling goods during transit and storage are all problems that the food sector deals with on a day-to-day basis. It becomes evident that a realiable food traceability data is crucial because of the growing customer demand for sustainable sourcing, product provenance and supply chain transparency, as well as for the legal and regulatory requirements imposed by governments. Thus, IMB Food Trust is a great example of how BCT can be used to improve the transparency of global supply chains. Essentially, IBM Food Trust works as a collaborative network involving growers, processors, wholesalers, distributors, and other stakeholders that share documentation securely among each other and thereby provide visibility about a product's history. IBM Food Trust provides a set of benefits for companies beyond traceability of products, namely reduction of food waste, meeting compliance requirements, improving supply chain efficiency, and so on (IBM, n.d.). For instance, Walmart uses this platform to track the journey of fresh food products. In the event of contamination, the BCT allows Walmart to quickly identify the source of the affected batches, reducing the scope of recalls and ensuring consumer safety (Hyperledger, 2023). This level of traceability not only enhances food safety but also builds consumer trust by providing clear, verifiable information about the product's origins.

Moreover, BCT can reduce operational costs and increase efficiency by automating processes through smart contracts and eliminating the need for intermediaries. As mentioned previously, smart contracts are self-executing agreements with terms directly encoded into their programming, which automate workflows and minimize the need for manual intervention. An example of a company that utilizes this feature of BCT is the German company Slock.it. In the real estate sector, Slock.it leverages the Ethereum BCT and the Internet of Things to facilitate the use of smart locks within the sharing economy. Property owners can list their apartments on a BCT platform in the form of ads, where smart contracts manage rental agreements and payments. When a guest pays for their stay, the smart contract automatically provides them with access to the property, eliminating the need for key exchanges or property management services. Besides renting property, the platform enables owners to share/swap property such as bicycles, electric cars, machinery, and more. This

automation lowers operational costs for the owner and simplifies the process for the guest, enhancing the rental experience and improving operational efficiency (Furtkamp, 2021).

BCT guarantees data integrity by creating a tamper-proof record of information. This is vital in industries where precise and trustworthy data is crucial, such as healthcare. For this, we will examine Medicalchain, a company leveraging BCT to create a secure, transparent, and user-controlled electronic health record system. It allows patients to manage and share their health data with healthcare providers, insurers, and researchers through conditional access permissions. The system uses a dual BCT structure, with Hyperledger Fabric ensuring data privacy and access control, and Ethereum powering applications and smart contracts. In addition, to supporting telemedicine consultations and facilitating a health data marketplace, this configuration allows for real-time, auditable transactions of health data and interfaces with several health-related services. Maintaining accurate and current medical records on the BCT can benefit patients in many ways, including increased security of their health data, decreased administrative costs, faster access to medical consultations, greater control over their private information, the ability to monetize their health data, and receive an overall better experience with healthcare (Medicalchain, 2018).

Lastly, a relatively new concept for value propositions named tokenization has been enabled by BCT. Tokenization is a transformative process that converts physical and digital assets into digital tokens on a BCT. Furthermore, tokens can be classified into fungible, non-fungible, and semi-fungible. Fungible tokens are interchangeable and divisible, with each token being identical to another; common examples include cryptocurrencies like Bitcoin and Ethereum, where one unit of the currency is the same as any other unit. NFTs, on the other hand, are unique and indivisible, representing individual items with distinct values, such as digital art, collectibles, and real estate titles. Semi-fungible tokens combine characteristics of both fungible and non-fungible tokens; they typically start as fungible, meaning they are interchangeable and divisible, but become non-fungible upon use or conversion, thus acquiring unique attributes or values. This distinction allows for a wide range of applications in digital and real-world asset representation (Wang & Nixon, 2021). RealT is a company that uses tokenization of real estate properties as their primary value proposition, enabling investors to become partial owners by purchasing fractional ownership through Ethereum-based tokens. A proportionate piece of the rental income is awarded to investors who purchase tokens that represent a portion of a rental property. By allowing these tokens to be sold on secondary markets, this strategy increases accessibility to real estate investing and lowers the barrier to entry. RealT democratizes real estate investments and creates new BMs and revenue streams, transforming the real estate sector with enhanced accessibility and liquidity (Request Finance, n.d.).

In conclusion, BCT can significantly enhance the Value Proposition segment of the BMC by providing security, transparency, efficiency, decentralization, and data integrity. By using unchangeable records—such as those used by Everledger in the luxury goods industry—

BCT guarantees genuineness and fosters customer confidence. IBM Food Trust is an example of how BCT's traceability and transparency capabilities address important supply chain issues in the food industry, improving consumer confidence and product safety. Slock.it demonstrates how automating rental procedures using smart contracts can lower expenses and improve operational effectiveness in the real estate industry. Medicalchain provides safe, reliable health records that enhance patient care, demonstrating the significance of data integrity in the healthcare industry. Finally, RealT emphasises how tokenisation has the ability to democratise investing options and increase market liquidity for real estate.

4.3 Blockchain and channels

In the BMC, Channels represent how a company communicates with and reaches its customer segments to deliver a Value Proposition. These Channels are essential for customer awareness, evaluation, purchase, delivery, and after-sales support. Effective channels can significantly enhance customer experience and operational efficiency, thereby driving business growth (Osterwalder & Pigneur, 2010b). BCT offers transformative potential for Channels by facilitating direct interactions, reducing intermediaries, and ensuring transparency and security.

BCT fundamentally transforms distribution and communication channels by facilitating direct interactions between producers and consumers, thereby reducing the need for intermediaries. This direct connection can lead to cost savings and faster delivery times (Giang & Tam, 2023). With the ability to provide transparency and security through the permanent records on the BCT, the technology can increase confidence and verification in industries that depend on it. If BCT would be implemented in an insurance sector, it can reduce conflicts that might arise between the insurer and the insured, because all of the information that is related to the case handling is locked on the BCT, providing a source of truth. As an example, in the case where a catastrophic weather event has resulted in a crop insurance scenario, BCT can pull out relevant weather data to first and foremost verify the size of the damage and then automate the appropriate payouts to the insured.

The removal of intermediaries is one of the most valuable effect that BCT can have on BMs. As mentioned in the previous chapter, where the Swedish government utilized the BCT for the purpose of land registry within the real estate market has shown a real example of how the middlemen/escrow agents could be removed from the old traditional process. Therefore, decreasing the costs for both the seller and buyer of property, thus benefiting both sides financially. This could be also considered in different in sectors such as real estate, finance, and supply chain management, where intermediaries have traditionally played a significant role. The security that has been provided traditionally for years by middlemen can be substituted by smart contracts implemented on a BCT, that guarantee a higher level of transparency and immutability. Having this in mind, in the case of the usage of a smart contracts in supply chains on one hand lowers the dependency on middlemen, while on the

other hand it introduces new channels that are based on shared common protocols (Montecchi et al., 2019).

Furthemore, removing unneeded intermediaries is not the only benefit of BCT implementation. As mentioned before with solutions such as IBM Food Trust mentioned in chapter 4.2, that enhance the transparency in the food industry therefore enabling the supplier to register a bad batch of products in the supply chain, solutions like VeChain enable the end-consumer to have a more transparent information of the origins of the products. For example in the wine industry, VeChain is an enabler of such an innovation by providing verification of authenticity for wine bottles. Each bottle is equipped with an NFC chip that stores information recorded on the BCT about the wine's origin, production, and distribution stages. Consumers can scan the chip with their smartphones to access this information, ensuring they are purchasing authentic and high-quality products (Kuhn, 2021). This can be seen as an innovation in the Channels component because it is a novel way that a company can communicate, or rather, show the value it provides to the consumers of their final products.

4.4 Blockchain and revenue streams

The different ways a business makes money from each customer segment are represented by the Revenue Streams block in the BMC. It outlines how the business will profit from giving its clients value. It is crucial for companies to determine their key revenue streams as they are the ones that keep their businesses sustainable and financially viable (Osterwalder & Pigneur, 2010b). Nevertheless, BCT can provide businesses with new avenues for income generation with revenue streams that were previously impossible or impractical to achieve. BCT implementation in BMs can significantly innovate the key revenue streams that businesses have had so far. To exemplify this we will consider a few use cases of real companies and discuss the way that BCT has enabled them to be able to establish different revenue streams.

With the innovative usage of BCT, the Brave Browser could hold the potential to transform the digital advertising industry. The Basic Attention Token, a cryptocurrency established on the Ethereum BCT, is the central component in Brave's business strategy when it comes to revenue generation. In addition, this token plays an important role in the brower's advertising approach which prioritizes privacy above all. The major innovation in the Brave Browser's BM, in regards to BCT, is that it provides its users with a direct cut from its revenue advertising, which has not been seen so far in the conventional standard advertising models. The users who are willing to watch advertisements receive their revenue share by being awarded with BAT tokens. On the other hand, advertisers are able to buy ad space only by using BAT, and in this way they can reach a more engaged and precise target audience (Brave Software, 2021). Nevertheless, advertisers access an audience that is interested, since users opt to view the ads and receive payment for their time. In other words, the revenue

stream that Brave has established comes from the advertisers that pay to have their ads displayed through the browser, while a small fraction of it goes to the users watching the ads. This model enables Brave to incentivize user engagement and subsequently increase the user experience and loyalty. Additionally, Brave can have other revenue streams that can come in the form of small BAT fees from users who engage in microtransactions made on the browser. Furthermore, users who want to access premium or higher quality content e.g. data services or high-resolution photos, can pay in BAT tokens providing Brave with yet another revenue stream. In addition, comments left on content can be ranked using BAT tokens, which could lead to more credible comments since a transfer in the form of token can be only authorized by a human who is willing enough to trade his or her tokens to back it up (Brave Software, 2021).

Another example of a revenue stream enabled by BCT is the model used by Audius which is a decentralized protocol for audio content. A BCT-powered music streaming platform that enables musicians to present their work and get paid directly by active listeners (Rumburg et al., 2020). Unlike other well-known music services like Spotify or YTMusic, Audius focuses on solving challenges that are faced by artists trying to reach optimal payments for their music. Even though the music industry generates over 43 billion US dollars in revenue, most of it goes to music producers and distributors, where content artists themselves receive a small share of 12 percent of the overall revenue. The project aims to give artists and curators more control over their music creations. When artists upload content to Audience, they can produce immutable records for their work, which will be secured by a decentralized network of nodes. Audius removes the middlemen in the traditional music industry by connecting artists directly to their fans. Thus, artists have sole ownership of their music and can decide how to monetize it on the platform. They can distribute their music free of charge or set custom fees for fans to unlock exclusive content. Unlike other music streaming services, Audius does not take a cut from artists' revenue. Music curators can receive 90% of the revenue in AUDIO, the native cryptocurrency of Audius. The other 10% will be given to stackers that support the Audius network (Rumburg et al., 2020).

Audius features may incentivize more artists to use the platform in the future to be more independent from labels and music production companies, therefore, improving their revenue and their freedom of producing music without the influence of the overall music industry. As such this may also lead to new popularity among customers who might be willing to pay more for streaming services, in addition, to exclusive and diversified content. Consequently, Audius can use its advantage to generate revenues through NFT sales and royalties. Artists can mint and sell NFTs representing their music or exclusive content, with transactions conducted in AUDIO tokens. Audius can take a small percentage of the sales and resales as fees, creating a continuous revenue stream. This innovative approach would allow artists to monetize their work further and engage with their audience in new ways, while also contributing to the platform's financial sustainability (Rumburg et al., 2020).

The implementation of BCT within different industries is a new concept that comes with high volatility. Therefore, some BMs might offer customers lucrative opportunities, but all could quickly crash due to market changes. That is why it is crucial to also point out an example of a successful BM at first glance, which later proved to not be so sufficient. Axie Infinity is a BCT Ethereum-based game developed by Sky Mavis, where players can breed, raise, battle, and trade fantasy creatures called Axies. The users of the game were incentivized to participate in different game activities like breeding the Axies, using them for battling and so gaining two distinct types of tokens - Small Love Potion (SLP) and Axie Infinity Shards (AXS). Whenever players bought, sold, or traded Axies and in-game items, a small fee was deducted and paid to the developers. Additionally, players paid fees in SLP tokens to breed new Axies. These breeding fees not only contributed to the game's revenue but also served to balance the in-game economy by regulating the supply of Axies. Another important revenue source for Sky Mavis was the sale of AXS tokens (Kriptomat, n.d.). However, the main source of revenue that popularized the game among the gaming and BCT community was the so-called tokenization economics, where the AXS token appreciated at its peak in 2021 to around 150 US dollars (Coingecko, n.d.). This price was held for a short period and has crashed since many of its users had initially used the game to obtain this token and quickly resell it in order to make profits. Thus, the token has plummeted in value which has decreased the interest of its users in the game and it has highlighted significant issues with its BM. Originally the vision of creators was to develop a model where users were playing the game, because of its entertaining features and not for its incentivization. However, the opposite happened and the biggest weakness of its BM was revealed as the token decreased in value, and most of the users left the game.

4.5 Blockchain and key resources and activities

As discussed, BCT BMs, even though they often deviate from traditional centralized models, still need to follow the main rule for establishing a good BM: enabling companies to gain a lasting competitive advantage in the long run (Zott & Amit, 2010). In previous chapters, we have explored several BCT models that follow different patterns of operation but, at their core, still aim to provide value propositions that differentiate them from other competitors. The key activities and resources that enable BCT BMs and maintain their competitive edge are explained in the continuation.

To achieve this comparative strength, it is important to recognize that every BCT-based business relies on a ledger that must be immutable (Nakamoto, 2008). Therefore, the information written on the ledger should be agreed upon and recorded by the different actors (nodes) on the BCT. As previously discussed, various types of consensus mechanisms (e.g., Proof of Work, Proof of Stake) determine how information is agreed upon between the involved parties (Buterin, 2013). Regardless of the consensus mechanism, nodes are a fundamental part of the infrastructure for such BMs. To build a strong infrastructure, every company should identify its resources and determine if they align with its BM.

As mentioned in the literature, key resources are crucial for businesses adopting BCT. Companies striving to compete in the market and deliver value to their customers must select the appropriate tangible and intangible resources (Mičieta et al., 2020). In the case of BCT, where much of the operability depends on DLT, it is easier to identify the intangible assets and resources that almost every BCT BM must rely on: nodes in permissioned or permissionless systems, consensus mechanisms, interoperability with other BCTs, and additional features such as smart contracts (Tapscott & Tapscott, 2016). Every BCT business must have a valid network of nodes to process the information shared on the BCT. Another critical resource is the DLT itself—whether the business will operate on an existing DLT or create a new one.

Additionally, the aspect of decentralization must be considered. For example, some solutions, such as IBM Food Trust, operate on a permissioned BCT, where access is restricted and controlled (Hyperledger, 2021). In contrast, others like Audius take a more decentralized approach, anticipating greater participation from their customers (Audius, 2020). Once these aspects are agreed upon, the necessary resources and activities can be easily clarified.

For example, in the case of a more centralized BCT application platform where the goal is to track a part of the supply chain, a key resource would be providing the verified actors in the supply chain with the necessary tracking resources, such as RFID chips and better transport vehicles specifically equipped with IoT technology to better track the state of the transported product (Treiblmaier, 2018). Another aspect would be the human factor, as the information stored could be done by certain nodes that have passed an additional approval process for joining the DLT. For example, the network could be more prone to misleading information from one node, and because of the permissioned and more centralized character, this node could be excluded from consideration without significantly hindering the chain's integrity, unlike in a decentralized system.

On the other hand, there are more decentralized BCT models that rely on a more open approach and are therefore less concerned with individual actors and more focused on the functioning of the network as a whole (Buterin, 2013). In such models, resources would be focused more on things like improving scalability and interoperability with other BCT businesses and activities. Here, resources such as improving the technical infrastructure (code) and the consensus mechanism should be at the heart of the model since, if manipulated, it could hinder the trust of its users (Zhang et al., 2020). Therefore, the employment of skilled computer engineers, analysts, etc., would be the biggest expense when it comes to allocated resources. To further this point, most BCT technologies use different programming languages, and especially in the case of smart contracts, Solidity is the main language. Compared to other languages like Python, there are fewer people skilled in Solidity, so the biggest resources should be allocated to supporting the main network and ensuring it is not vulnerable to cyberattacks (Wood, 2014).

After discussing the necessary resources, the other main point for the BMC are the activities in the model of a company. Activities in BCT-based models, as mentioned before, depend on the centralization or decentralization of the BCT BM, while the activities are more dictated by the on-chain or off-chain aspect of the business. Off-chain refers to when there are parts that occur outside the digital world, therefore requiring things like oracles to take information from the real world into the digital world (Mougayar, 2016). For instance, in the case of a BCT-based insurance company where crops are insured, as mentioned before, to determine if a specific insurance policy should be paid to the farmer, there must be some form of validation of the temperature. Such validation could be obtained by different sources or even temperature-measuring devices like thermometers that are connected and transmit the information to the internet so that a smart contract can check them (Christidis & Devetsikiotis, 2016).

On the other hand, if there is a BCT-based company that trades tokens from different sellers at different prices, since everything happens on-chain, the verification process is significantly easier. So the activities depend on digital or material information, but the ultimate goal is to store untampered information and then use it for different activities like analysis, trading, etc.

To sum up, since BCT businesses are more digital, identifying key resources and activities depends on the key model—whether permissioned or permissionless. Once the key model is established, the resources can be more clearly identified, and then the activities can be determined depending on the state of the data that operates on the BCT.

4.6 Blockchain and key partnership

The Key Partnership block in the BMC considers the various cooperations crucial for the companies' BMs. Strategic alliances, joint ventures, and buyer-supplier relationships are some examples of these partnerships that can be formed to guarantee that companies can deliver a consistent supply of products or services (Osterwalder & Pigneur, 2010b). On one hand, as we previously discussed, the usage/adoption of BCT may result in a reduction of already existing intermediaries, however, the utilization of BCT can also make it possible to add new partners that businesses would not have considered otherwise.

Companies that use or adopt BCT may heavily start relying on various partners that can contribute to the overall success of their BMs. From a technological perspective, companies that implement BCT in their BM might have to rely on BCT platform providers and development companies. Ethereum as a major player in the BCT market can offer the underlying infrastructure to companies that are willing to adopt BCT or develop applications. On the contrary, if the company decides that it would rather build its own BCT it will undoubtedly need to partner up with specialized development companies that have the expertise in the design, development, and employment of tailor-made BCT solutions. With

these partnerships set in place the organization that wants to employ BCT can ensure that they have the technical expertise for successful functioning of the infrastructure and its components, without having to fear that they lack the experts in this regard.
In addition, partnerships that involve business-to-business collaboration aimed at supporting the overall progress of BCTs and DLTs in the wider industry can play an important role in the BM. To exemplify this we can consider the Hyperledger Foundation project is essentially a non-profit organization that was founded in 2015 as part of the Linux Foundation with the aim to create an open-source community that connects and supports numerous organizations and individuals in their journey of industry wide BCT adoption. Many open source software projects, conceptualized and developed by its community, are the foundation of enterprise BCT implementations. These projects are hosted by the Hyperledger Foundation and are freely available for usage by vendors, service providers, end users, startups, and others that want to create and implement BCT networks. Therefore, the foundation brings together people and organizations with diverse needs and encourages collaboration in the creation of shared solutions that may serve as the cornerstone for BCT success. The leading businesses from various sectors, such as Deutsche Telekom AG, Fujitsu, Huawei, Siemens and many more (Hyperledger, n.d.), have joined Hyperledger to contribute to the development and configuration of the BCT ecosystem, sharing their use cases and applications. Altogether the members of the foundation govern the community and set the direction that they will follow in the future (Hyperledger Foundation, 2018).

As we previously discussed, organizations that are interested in implementing BCT within their BMs or have already done so need to be aware of the legislative perspective of this technology. Therefore, other crucial partnerships that need to be established in the BC BMs could be those with consulting companies that provide legal services. Working closely with such legal advisors can help organizations that want to / have adopted BCT to face the regulatory challenges that come with the technology with more confidence.

In addition, they can ensure that organizations align their value propositions to legal requirements, help in the development and implementation of compliance procedures, and provide auditing services for BCT. Nevertheless, such services from legal partners can ensure that the BM stays sustainable by lowering the risk of failure due to changing laws and regulations surrounding BCT.

However, there could potentially be other partnerships included in the BM that would highly depend on the unique value propositions that organizations propose to their customers. In the case of VeChain for instance, to be able for them to provide the immutable record that the whole journey of wine bottles, they have to partner up with vendors that produce the NFC tags. Nevertheless, this would probably be the case for all BMs that provide product history tracking based on BCT - they will have to rely on vendors that provide tangible technology components such as NFC tags and RFDI readers.

The partneships established from the technical and regulatory aspects of BCT, as well as other specific ones that depend on the different value propositions of businesses are of high importance for the overall success of the BCT BMs. Organizations can ensure the successful delivery of their products and services by mitigating risk with the partnerships that provide the expertise and the support needed for their value propositions and the positive outcome of their BMs.

4.7 Blockchain and cost structure

Using BCT can significantly affect a company's cost structure as outlined in the BMC. The most significant costs incurred while conducting business under a specific BM are detailed in the cost structure component of the BMC (Osterwalder & Pigneur, 2010b). BCT can affect these costs in a number of ways, including as by lowering transaction costs, decreasing the need for middlemen, improving operational efficiency, and adding new expenses for the installation and upkeep of the technology.

As we previously discussed, in the traditional BM transactions often need to be mediated and verified by certain financial intermediaries that charge fees for their services. Depending on the type of transaction (within country borders or international) the fees can range from minimal to substantial and can represent significant costs that organizations need to bare. However, with BCT the cost of the transactions fees can be minimized, because transactions are verified on the network by nodes/miners. For instance, in the Ethereum network the transaction fees take the form of “gas” which represent tiny fractions of the cryptocurrency Ethereum (ETH). At the time of the transaction, supply, demand, and network capacity all affect the specific value of the gas or ETH. Thus, the fees can be different each time a transaction occurs (The Investopedia Team, 2024).

Moreover, BCT can simplify and decentralize the process of transaction costs by bring all of the stakeholders that are involved in one BM together. For instance, in construction building there several stakeholders that work in a hierarchy, namely a client, architects, a design team, an engineering team, a general contractor, subcontractors, and their suppliers of materials. If all of these stakeholders are brought together on a BCT network, they would have better transparency when it comes to overall quality and safety of the construction of the building, since they we will be able to access a one and only source of truth - information that will be permanently recorded on the BCT thus reducing risk and fraud simultaneously. In addition to this they can save on costs that construction projects often require such as service fees/wages payed to auditors, accountants and project managers (Dakhli et al., 2019).

Furthemore, BCT can increase operational efficiency by process automation though smart contracts and the provision of an unchangeable, transparent ledger of all transactions (Hasan et al., 2020). As a result, less time and money are needed for audits, reconciliation and

record-keeping. Again if we take the example of IBM Food Trust, the solution can provide significant cost savings that can be associated with data entry errors, products recalls, and most importantly the manual checking of changes that appear in the supply chain. With the BCT there would be no need to hire additional employees that will need to keep in check all of these things.

Although, BCT can reduce certain costs, it can also subsequently introduce new costs that come from its implementation. Further speculating, if the company decides that its wants to build its own private BCT there might be higher upfront costs related to its development that might differ in range and depend completely on the type of the project. In addition, there might have to be a need to retrain or recruit new employees that have the skills to develop and later maintain or audit the BCT network.

On the other hand, companies that want to avoid incquirring these costs might decide to rely on a public BCT. In addition, we need to also consider costs that appear due to the computational power of BCT and are primarily connected to energy consumption. Public BCTs usually depend on PoW consensus mechanism, which are known to consume quite a lot of electric energy, while private BCs can use PoS mechanism that require lower energy consumption (Dock, 2024). Additionally, it is crucial to mention that distinct BM that are BCT-based might include other specific costs that are related to their specific unique value propositions that they provide for their customers.

5 RESEARCH METHODOLOGY

5.1 Description of the methodology used

The upper three chapters of this thesis consist of a literature review to help understand the theory behind BMs, the basics of BCT, and how BCT implementation or usage impacts BMs. This review lays the foundation for understanding how BMs work and how BCT affects them. Analyzed through the blocks of the BMC and exemplified by the use cases of various companies, this review provides a profound understanding of the potential impact on companies' BMs.

The next part of this thesis focuses on the practical part and explores how BCT implementation has disrupted companies in Slovenia. Using the previously gathered information from the literature review and a similar study by Treiblmaier and Špan (2022), I’ve created an online survey on Google Forms, which investigates blockchain adoption and its impact on businesses.

The survey, however, also includes open questions regarding areas specific to the thesis that were not fully addressed in the paper. I’ve distributed the survey to relevant stakeholders in companies that have been recognized as using or implementing BCT in their BMs. These

companies were identified based on criteria such as active involvement BCT projects, innovative BCT based services, or industry recognition for BCT adoption. I found these companies using Tracxn, where profiles provided details such as the names, email and functions of key stakeholders. The survey was distributed through LinkedIn in profiles of these stakeholders to gather insights directly from the relevant decision makers.

The survey includes a mix of closed and open-ended questions designed to explore the impact of BCT on the respective blocks of the BMC, which include Key Partners, Key Activities, Key Resources, Value Propositions, Customer Relationships, Channels, Customer Segments, Cost Structure, and Revenue Streams. When developing the survey, questions are based on key studies in BCT adoption and BMI, such as Osterwalder and Pigneur's (2010) Business Model Canvas, Beck & Müller-Bloch's (2017) work on blockchain-driven innovation, and Upadhyay's (2024) analysis of blockchain's role in improving trust and transparency. This ensures the survey is grounded in literature and focuses on blockchain's impact on business processes. The questions aim to assess key areas of blockchain integration such as efficiency, transparency, innovation, and cost structures.

With this mix of questions, I've gathered both quantitative and qualitative data. With the help of this data, I've prepared a SWOT analysis, highlighting the strengths, weaknesses, opportunities, and threats associated with using BCT to create new or disrupt existing BMs.

Interestingly, Slovenia has many companies that use BCT, which is supported by the government (Tracnx, 2024). Some notable examples include:

1. NiceHash: A cryptocurrency cloud mining and hash rental service based in Maribor, founded in 2014.
2. The Crypto App: A cryptocurrency monitoring tool for consumers, located in Slovenj Gradec and founded in 2018.
3. NAKA: Provides BCT decentralized payment solutions, located in Ljubljana and founded in 2017.
4. Blocksquare: Offers BCT - based real estate investment solutions, located in Ljubljana and founded in 2017.
5. Apillon: A Web3 app development platform for the Polkadot ecosystem, located in Škofja Loka and founded in 2019.
6. BC Vault: A hardware wallet for cryptocurrencies, based in Maribor and founded in 2017.
7. Suncontract: Aims to enable energy trading using BCT, located in Ljubljana and founded in 2016.

Moreover, I've distributed my survey to companies and organizations that work on developing and implementing BCT solutions.

8. STRAMIND: Consulting firm focused on blockchain-based solutions and Web3 technology.
9. Blokiments: IT company focused on digital innovation and providing secure and efficient blockchain-based solutions for sectors that require reliable data management systems.
10. Blockchain Lab: is a university-based labotory at the University of Maribor in Slovenia that focuses on research and development related to BCT.

11. AFLabs: IT company focused on BCT development and innovation.

The surveyed companies perfectly showcase the range of blockchain applications in Slovenia, from cryptocurrency services to real estate and energy trading. The survey responses offer a closer look at how blockchain is being practically implemented and its influence on different sectors. Consequently, the collected information helped as the basis for the SWOT analysis.

5.2 Survey results and analysis

The next step involved an in-depth analysis of the survey responses to provide a detailed view of how BCT influences critical components of the BMC. The results presented here focus on the main findings, incorporated into a SWOT analysis. This analysis includes questions from the survey and highlights the strengths, weaknesses, opportunities, and threats associated with BCT adoption. These key insights provide a clearer understanding of the practical implications of BCT for businesses in Slovenia and its potential to disrupt traditional BMs.

While this chapter centers on the most relevant survey findings, the full set of results, including open-ended questions, is detailed in **Appendix 3**. Many of the survey questions were open-ended and have been analyzed qualitatively, while the presented responses were selected for their direct impact on BCT's role in business model components.

5.2.1 Customer Segments and Customer relationships

BCT has a promising impact on how Slovenian companies interact with their customers. Transparency and trust in transactions are the most evident benefits, showing that customers are more confident when interacting with businesses using blockchain. When asked about the extent to which BCT has enhanced transparency and trust with customers, the responses were mostly positive. On a scale of 1 to 5, the average score was 4.27 indicating that most of the participants believe BCT has significantly improved these aspects. While the majority reported substantial gains in transparency end efficiency, a smaller group observed moderate

benefits. Customer's value BCT's transparent and unbreakable nature, which removes uncertainties and improves trust in transactions.

Furthermore, the importance of data privacy protection and faster service delivery suggests that BCT is improving security but also operational efficiency, which leads to higher customer satisfaction.

When asked about the importance of BCT in automating customer relationship management (CRM) processes, the responses leaned towards a high level of significance. With an average score of 4, most participants rated BCT as very important, emphasizing its critical role in enhancing CRM automation. A few respondents remained neutral, indicating that while BCT plays a vital role for some, it may not be as central to CRM for others. Only one respondent considered it not important at all, suggesting that blockchain's impact on CRM varies across different business models.

Table 1:BCT effect on customer interactions or the value provided to customers

Response	Responses
Increased transparency and trust in transactions	82%
Offering new services lice secure digital identities	45%
Improved customer loyalty through enhaced security	27%
Faster and more efficient service delivery	63%
Better protection of customer data and privacy	72%
Other*	%

* The new solution we are developing will provide customers with all the mentioned values; We don't have customers yet, we are startup; Blockchain allows us to explore innovative digital asset services such as NFTs, giving customers access to a whole new realm of opportunities

Source: Own Work

Table 1 suggests that BCT has had a notable impact on improving customer interactions, with 82% of respondents highlighting increased transparency and trust as key benefits. Additionally, faster service delivery and better protection of customer data were recognized by 64% and 72% of companies, respectively. Around 45% noted offering secure digital identities as a valuable service, while 27.27% saw enhanced customer loyalty through improved security measures. A small portion of respondents mentioned exploring digital asset services like NFTs, while some startups indicated they are still in the development phase, lacking direct customer interaction at this stage.

5.2.2 Blockchain and value proposition

The responses from Slovenian companies are showing how BCT has highly impacted the BMs of these companies, aligning with their value propositions to deliver innovative services, reduce costs, and improve security and transparency.

In my findings, BCT has positively influenced the value proposition offered by businesses with a notable emphasis on increasing trust and transparency. The question asked respondents to rate how Blockchain affected their business's value proposition, with options ranging from "significantly enhanced" to "detracted" or "no impact," including an option for no experience. The coefficient received was 4.81. indicating that influence generally aligned with significantly encancing the value preposition as per a scale that ranges from significantly enhancing the value proposition as per scale that ranges from significantly enhanced to detracted due to complexity or cost.

For NAKA, BCT, as a foundation of their BM, enables them to provide a decentralized payment system, eliminating intermediaries and lowering transaction costs. This core technology allowed them to offer new services like non-custodial payment cards and smart contract automation, expanding their reach globally. This ability to offer secure and scalable crypto payment solutions to both merchants and customers shows how BC has redefined the operational structure of the company and further enhanced their value proposition through increased transparency and efficiency.

Table 2: Future opportunities foreseen with continued blockchain adoption (Value Proposition)

Response	Responses
Opportunities in new market segments.	82%
Increased efficiency through automation	64%
Technological advancements and competition.	73%
Tokenization of assets for new investment opportunities	45%
Rapid evolution requiring continuous adaptation.	18%
Simplied regulatory compliance	36%

Source: Own Work

Table 2 outlines the potential future opportunities companies foresee with continued blockchain adoption, particularly in terms of value proposition. A large majority (82%) of respondents see blockchain opening opportunities in new market segments, showcasing its potential for market expansion. Increased efficiency through automation was noted by 64%, reflecting blockchain's role in streamlining operations and reducing manual processes. Additionally, 73% of companies anticipate that blockchain will drive technological advancements and increased competition, positioning it as a key factor in staying

competitive. Tokenization of assets, mentioned by 45%, also presents new investment opportunities for businesses. Interestingly, 18% recognized the rapid evolution of BCT, which will require businesses to adapt continuously, while 36% see the potential for simplified regulatory compliance, a benefit of blockchain's transparency and security features.

5.2.3 Blockchain and Channels

The responses in Table 3 highlights the impact of BCT on communication channels within busineses. For several businesses, such as STRAMIND**,** NiceHash**,** NAKA**,** Apillon**,** and The Crypto App, BCT has facilitated direct interactions between stakeholders, eliminating intermediaries and streamlining communication processes. This shift allows for faster, more transparent exchanges within their operations, making interactions more efficient.

In addition to facilitating direct interactions, companies like STRAMIND and SunContract also reported an improvement in the security of communications. Blockchain's decentralized and encrypted structure has enhanced the protection of sensitive information, reinforcing trust among stakeholders.

Table 3: Blockchain technology changing the communication channels within the business model

Response	Responses
Facilitated direct interactions between stakeholders	55%
Improved security of communications	27%
No significant changes to communication channels	36%
Complicated communication processes	0%
Not applicable / No experience with Blockchain	18%

Source: Own Work

Some companies responded that BCT hasn't meaningfully changed their communication channels, or they have not yet leveraged its potential in this area. For these companies, communication methods remain largely unchanged, indicating that blockchain's impact on communication varies based on how integrated it is within the company's processes.

Overall, for those companies that have utilized BCT in their communication channels, the main benefits have been direct stakeholder interactions and enhanced securit**y**. For others, communication remains unaffected as they continue using traditional methods.

5.2.4 Blockchain and Revenue Streams

Table 4 highlights the significant impact of BCT on company revenue streams. STRAMIND, Apillon, and SunContract have successfully used BCT to introduce new revenue streams by

developing innovative products and services. These include offerings like digital assets, product authentication services, and blockchain-based solutions, which have allowed these companies to access new markets and customer segments. This shows blockchain's role as a driver of new BMs, allowing companies to diversify and grow beyond traditional offerings.

Several companies, such as NAKA, The Crypto App, and BC Vault, have seen efficiency gains from BCT, particularly through cost reduction in operations. The ability to automate processes and eliminate intermediaries has not only streamlined their workflows but also allowed for more efficient resource allocation. This efficiency translates directly into higher profitability, as these companies can reduce overhead while expanding their revenue-generating capabilities.

Enhanced customer trust and loyalty have significantly contributed to revenue growth for companies like NAKA, Blocksquare, and NiceHash. Blockchain's transparency and security features have helped build stronger customer relationships, promoting trust and improving retention rates. Customers feel more secure and engaged with these companies' offerings, which leads to increased revenues.

Table 4: Blockchain influencing company's revenue stream

Response	Responses
Opened new revenue streams through innovative products and services	82%
Efficiency gains from blockchain have reduced operational costs	64%
Increased revenue through enhanced customer trust and loyalty	45%
Increased revenue by offering premium blockchain-based services	36%
Launched a new service to verify the authenticity of products.	45%

**Blockchain certainly opens new concepts and has also been the starting point for an innovative digital product under development. This will transform our existing range of services into new revenue streams, new business models, and new or expanded target groups and markets; decentralization and transparency blockchain offers have enabled us to explore new markets and business models*

Source: Own Work

Companies such as NiceHash, SunContract, and The Crypto App have used the ability to offer premium blockchain-based services as a key strategy. These companies have successfully positioned their BCT solutions as high-value, premium services that cater to a market willing to pay more for enhanced security, efficiency, and transparency. This has created an additional revenue stream that allows them to differentiate themselves in competitive markets.

Furthermore, Apillon and Blocksquare have capitalized on the decentralization and transparency of BCT to explore new markets and BMs. These companies have tapped into

previously unexplored revenue opportunities by offering services like real estate tokenization and fractional ownership, expanding their market reach, and offering unique solutions that appeal to both traditional and emerging customer bases.

In conclusion, BCT has significantly impacted revenue streams across these companies by enabling innovation, cost reduction, customer loyalty, and premium services. The technology has not only helped businesses grow in the short term but also positioned them for long-term market expansion and sustainable growth through new BMs and cutting-edge services.

5.2.5 Key Activities and Key Resources

Slovenian companies adopting BCT operate in a different landscape from traditional centralized models but still follow core principles for building a competitive BM.
This analysis examines the core activities and resources that support these models based on input from different companies. The responses suggest that companies clearly understand that establishing a robust network of nodes is essential for processing shared information effectively.

Key resources for BCT businesses encompass both tangible and intangible assets. Companies like NAKA and Apillon illustrate how their operations rely heavily on intangible resources such as nodes, consensus mechanisms, and smart contracts. Their focus on these elements aims to ensure the blockchain infrastructure is both functional and resilient. For instance, NAKA's approach to decentralizing payment systems underscores the importance of a valid network of nodes to facilitate secure transactions, aligning with the literature's assertion that key resources are vital for competing effectively in the market.

Table 5: Issues related to blockchain adoption

Response	Responses
Worked closely with regulators to ensure compliance.	64%
Invested in a scalable blockchain platform.	45%
Conducted regular training sessions for staff.	27%
Implemented a phased approach to gradually integrate blockchain.	45%
Partnered with technology experts to overcome technical challenges.	82%

Source: Own Work

The technological infrastructure, particularly the choice between operating on existing DLT or developing new ones, is another critical resource. The responses reveal that companies like NiceHash and SunContract face challenges related to integrating BCT into existing systems. This highlights the need for investment in scalable BCT platforms that can

accommodate the unique demands of their operations, thus ensuring that their BM remains competitive.

Human capital is also vital, as the workforce must have the necessary skills to utilize BCT effectively. Companies like AFLabs note that training and development are crucial for addressing the challenges of technological integration and regulatory compliance. This investment in human resources is essential for fostering innovation and ensuring the successful implementation of BCT applications.

Moreover, Table 5 outlines how businesses tackled challenges in adopting Blockchain. The most common solution was partnering with technology experts, adopted by nearly 82% of respondents. Around 64% worked with regulators to ensure compliance, while about 45% invested in scalable platforms and took a phased approach to integration. Fewer companies, around 27%, focused on regular staff training to address these challenges.

In conclusion, the landscape of blockchain-based BMs in Slovenia showcases a clear alignment between identifying key resources and activities and the core principles of BCT. By understanding the significance of nodes, consensus mechanisms, and technological infrastructure, as well as prioritizing human capital and regulatory compliance, these companies are well-positioned to navigate the complexities of BCT adoption. The interplay between these elements ultimately supports the creation of competitive advantages that enable long-term success in an increasingly digital marketplace.

5.2.6 Blockchain and Key Partnership

It's clear that the integration of BCT has facilitated new collaborations across various sectors. Many companies recognize that BCT not only promotes new alliances but also improves existing relationships. For instance, organizations like STRAMIND and Blokiments note that the technology has opened doors for partnerships, especially with other businesses in the BCT and Web3 space. This trend stresses blockchain's ability to create synergies that were previously unattainable.

NiceHash demonstrates this evolution by utilizing smart contracts to eliminate intermediaries, streamlining processes, and enabling smoother collaborations with tech innovators. Similarly, Apillon proves that blockchain’s secure and transparent platform allows trust, making it easier to work with various partners, particularly in dApp development. Blocksquare further illustrates this by forming alliances with property owners and technology providers, which broadens their reach and enhances the accessibility of real estate investments through tokenization.

Table 6 reflects how companies have integrated BCT into broader business ecosystems. Many respondents view BCT as a core component of their IT infrastructure, emphasizing its foundational role in operations. The technology is increasingly integral to supply chain management, enhancing transparency and efficiency in logistics and product tracking.

Additionally, companies have seen marked improvements in the speed and security of financial transactions, showcasing blockchain's role in bolstering operational efficiency. BCT has also improved cross-departmental collaboration by creating shared data platforms, allowing for a more comprehensive view of operations. This collaborative approach allows teams to collaborate more effectively and share insights seamlessly.

Table 6: Blockchain integration into the broader business ecosystem

Response	Responses
Became a core part of our IT infrastructure	64%
Integrated with customer relationship management systems for a holistic view.	27%
Integral to supply chain management	27%
Used in financial transactions to improve speed and security.,	54%
Enabled cross-departmental collaboration through shared data platforms.	73%

***** *Building an ecosystem is a must when starting to develop blockchain solutions. Yes, we are building our own global ecosystem*

Source: Own Work

Overall, while some companies are actively building their own global ecosystems, the overarching theme is that BCT has not only integrated into existing business frameworks but has become a catalyst for innovation and collaboration. By establishing strategic partnerships and embedding BCT across various facets of their operations, companies are well-positioned to navigate the complexities of the modern business landscape and unlock new opportunities for growth and success.

5.2.7 Blockchain and Cost Structure

Table 7 highlights BCT has significantly influenced the cost structures of companies, bringing about both reductions in expenses and new considerations. Many organizations have noted a decrease in fraud-related costs, which directly impacts their bottom line. This reduction is largely attributed to the transparency and security that BCT provides, making it more difficult for fraudulent activities to occur.

Another central area of impact is the lowering of transaction fees. By eliminating intermediaries, companies have seen substantial savings in transaction costs, allowing for more efficient financial operations. This streamlining is further enhanced using smart

contracts, which not only automate agreements but also cut down on legal costs and administrative overhead, contributing to a leaner operational model.
While most responses point to cost reductions, a small percentage of companies have experienced increased expenses due to developing their own BCT solutions or maintaining nodes. These investments, however, are often viewed as necessary steps toward long-term efficiency and sustainability.

Table 7: Blockchain influencing company's cost structures

Response	Responses
Reduced fraud-related costs, positively impacting the bottom line	36%
Smart contracts have cut down on legal costs and administrative overhead	45%
Reduced transaction fees significantly by eliminating intermediaries	55%
Other (Due to the development of our own solution, our costs have increased substantially.)	9%

** We have costs for nodes; Automation and transparency provided by blockchain have streamlined processes, further reducing unnecessary costs related to manual interventions*
Source: Own Work

However, high initial investment costs have been a notable challenge for some companies, particularly those developing their own BCT solutions or maintaining nodes. These upfront expenses, while significant, are often viewed as necessary for long-term efficiency and sustainability.

Overall, the automation and transparency offered by BCT have streamlined processes, leading to significant reductions in unnecessary costs associated with manual interventions. As organizations continue to adapt to this technology, the influence on their cost structures is likely to evolve, highlighting both immediate savings and potential investments for future growth.

5.3 SWOT Analysis

The SWOT analysis summarizes the strengths, weaknesses, opportunities, and threats associated with implementing BCT in Slovenian companies. The key analysis are presented in Figure 5. By synthesizing the data collected from the survey, this analysis provides a thorough overview of how BCT influences BMs. The insights gained illuminate the unique advantages BCT offers, the challenges organizations face, growth potential, and external factors that could impact the successful adoption of this transformative technology. Through this framework, we can better understand the practical implications of BCT within the Slovenian business landscape.

Strengths

Collected responses highlight several key strengths of BCT, emphasizing its transformative impact on businesses. A notable strength is the enhanced transparency and security provided by blockchain, which multiple companies mentioned. These benefits are also significant strengths that customers appreciate. BCT security helps in building strong customer relationships, which improves trust and loyalty. Customers appreciate the security measures that BCT provides, which contribute to long-term partnerships.

This ability to verify transactions in real-time and ensure data integrity without manual oversight is a significant advantage, promoting greater trust among stakeholders. By ensuring data integrity and providing clear visibility into transactions, companies build trust and confidence among their users. This transparency is further bolstered by the improved product authenticity and traceability that BCT offers, allowing customers to verify the origins and quality of products with ease.

Innovative blockchain-based product offerings are another critical strength, showing a dedication to using advanced technology to address the changing market's needs. This innovation not only attracts customers but also sets companies apart from competitors. The ability to offer customized BCT solutions tailored to specific customer needs demonstrates a commitment to flexibility and responsiveness, which is crucial for maintaining competitive advantage. More advanced BCT solutions indicate that competitors may leverage cutting-edge technology and features that enhance functionality and user experience. This advancement can create a significant gap in service offerings, compelling companies to invest in their own technology development.

Another strength is the user-friendly BCT applications that many companies have developed. This focus on usability not only enhances the customer experience but also encourages broader adoption of BCT solutions.

The strength of faster and more reliable transactions highlights how BCT streamlines processes, reducing delays and enhancing customer satisfaction. This efficiency not only improves service delivery but also positions businesses as reliable partners. An important strength is the operational efficiency that BCT enables. Companies like NiceHash and Apillon noted that the technology not only simplifies processes but also eliminates unnecessary steps, ultimately saving time and resources. This streamlining effect can improve productivity and a more agile operational framework. The efficient operational processes improved by BCT automation highlight a commitment to streamlining operations, resulting in reduced costs and enhanced productivity.

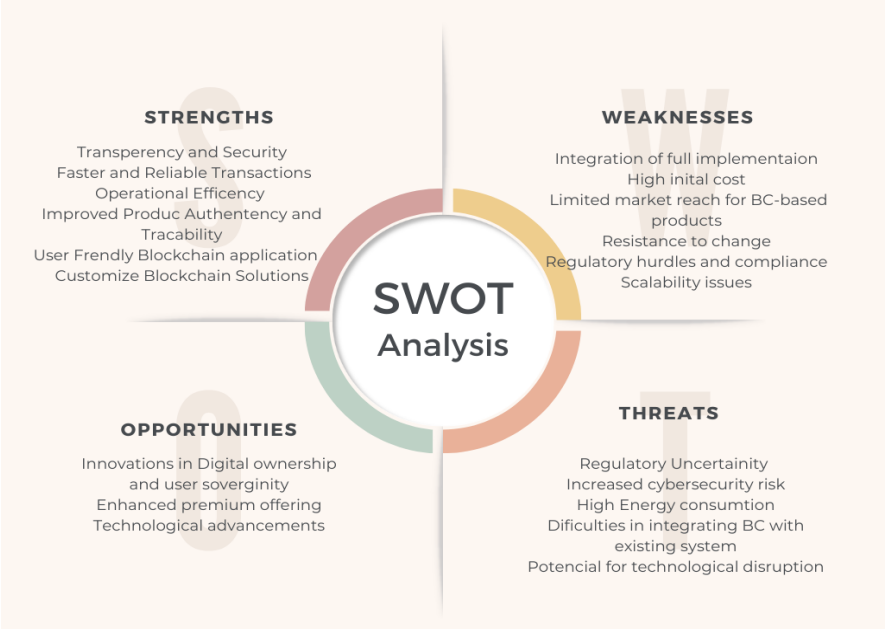
A major strength is the strong brand reputation, which has been enhanced by the transparency that BCT offers. This reputation builds customer trust, positioning companies

as reliable and credible players in their respective industries. The aspect of greater market penetration with BCT applications suggests that competitors have successfully established themselves in the marketplace, capturing a larger share of customers and creating a more robust presence. This can result in greater brand loyalty and recognition among consumers. Another strength identified among competitors is the better integration of BCT with other technologies. This ability to seamlessly combine BCT with other systems can lead to enhanced efficiency and improved overall performance, providing a competitive edge in delivering comprehensive solutions.

Collectively, these strengths highlight critical areas for companies to address as they navigate the competitive landscape. Understanding these advantages can help organizations strategize effectively, innovate their offerings, and enhance their market position in the realm of BCT.

Overall, the data suggests that many companies already take advantage of blockchain's key benefits, such as transparency, security, and efficiency. While others are moving towards exploring more advanced uses. This positions BCT as a catalyst for improving operations and driving future innovations.

Figure 4: SWOT Analysis Diagram



Source: Own Work

Weaknesses

The responses point out several glaring weaknesses and challenges companies face with BCI, emphasizing critical areas for improvement.

Indicate that the full implementation phase of BCT integration is the most challenging for companies. This complexity arises from difficulties in aligning BCT solutions with existing processes, managing resource allocation, and ensuring adequate stakeholder training. High initial investment costs are a notable barrier, with companies needing to allocate significant resources to adopt BCT successfully. This investment often encompasses not only technology acquisition but also training and system integration.

Limited financial resources for blockchain projects compound these challenges, making it difficult for companies to invest in the necessary technology and talent to drive successful implementation.
Another major challenge is the limited market reach for BCT-based products. This suggests that companies may have difficulty expanding their customer base or effectively marketing their offerings, limiting growth potential and market competitiveness.

Resistance to change from employees or stakeholders poses another challenge, albeit one that is less frequently reported. This resistance can stem from a lack of understanding or fear of the new technology, highlighting the importance of effective communication and training during the transition.
The need for user education about the technology underscores the importance of ensuring that customers and employees understand blockchain's value and functionality, which is crucial for driving adoption and engagement.

Regulatory hurdles and compliance issues are another major challenge affecting a substantial number of respondents. Navigating the evolving legal landscape surrounding blockchain can create uncertainty and complicate implementation efforts, requiring ongoing attention and adaptation.

Additionally, scalability issues with high transaction volumes emerge as a critical concern. As companies grow and transaction demands increase, ensuring blockchain systems can handle larger volumes efficiently becomes essential for maintaining performance and reliability.

Overall, these challenges underscore the multifaceted nature of BCI, emphasizing the need for careful planning, effective communication, and ongoing support to navigate the complexities and successfully harness the benefits of this transformative technology. Moreover, these weaknesses highlight key areas that companies must address to enhance their BCI efforts, improve operational efficiency, and better position themselves in a competitive landscape.

Opportunites

There are many opportunities for companies looking to leverage BCT for growth. Indicate several strategic ways companies can use their strengths to capitalize on market opportunities through BCT.

A primary approach is expanding blockchain product lines, with a significant majority recognizing the potential to diversify offerings and meet growing customer demands. Additionally, entering new geographical markets with blockchain solutions presents a valuable opportunity to broaden their reach and tap into emerging markets.

The rise of DeFi and tokenization presents new avenues for innovation and product development, along with the potential to expand into new regions as blockchain adoption increases.

Innovations in digital ownership and user sovereignty are key opportunities, particularly for Blockchain Lab, which emphasizes the shift towards empowering users through BCT. This focus on user-centric solutions is echoed by NiceHash, which identifies growth in sectors like finance, supply chain, and healthcare areas where security and transparency are paramount.

They also mention the potential of DeFi and tokenization to create innovative products and expand into new regions as blockchain adoption increases. STRAMIND emphasizes the vast potential of their solutions to reach a large global audience, indicating that the scalability of blockchain applications can unlock significant market access.

Similarly, NAKA aims to tap into new markets with blockchain-driven solutions and emphasizes the importance of collaboration with blockchain partners to enhance their offerings. Blocksquare sees growth potential in expanding real estate tokenization to new markets, promoting fractional ownership globally.

Finally, SunContract envisions growth through entering new markets related to digital assets and tokenization, leveraging blockchain to provide faster and more secure services that enhance customer trust. Together, these insights illustrate a dynamic landscape where BCT offers numerous pathways for companies to innovate and expand, ultimately driving sustainable growth.

The Crypto App highlights opportunities to enhance premium offerings, such as advanced real-time tracking and decentralized portfolio management tools, while BCT Vault focuses on expanding secure multi-wallet functionalities to attract institutional users.

Lastly, technological advancements and competition are expected to be key growth drivers, prompting continuous innovation. The tokenization of assets offers new investment opportunities, enabling fractional ownership and broader access for diverse investors.
Together, these insights illustrate a dynamic landscape where BCT presents numerous avenues for growth, driven by innovation and a focus on meeting evolving customer needs.

The responses highlight several promising future opportunities with continued blockchain adoption. Most foresee new market segments opening and driving innovation and new BMs. Companies also anticipate increased efficiency through automation, allowing for streamlined processes and improved productivity.

Threads

The responses highlight several threats that could impact companies utilizing BCT. There are several key threats linked to continued blockchain adoption. Regulatory challenges and uncertainty stand out as a primary concern, potentially hindering innovation, and complicating business compliance.

There are also increased cybersecurity risks associated with evolving threats from cybercriminals, necessitating stronger security measures. The lack of standardization across platforms poses another significant issue, leading to compatibility challenges and fragmentation within the blockchain ecosystem.

Additionally, the high energy consumption and environmental impact of blockchain operations raise sustainability concerns that could attract scrutiny. The potential for misuse in illegal activities further threatens the technology's reputation, prompting calls for stricter regulations.

Moreover, difficulties integrating blockchain with existing systems can create operational hurdles for companies, complicating the transition to new technologies. Together, these threats highlight the complexities and risks organizations must address as they embrace BCT.

Furthermore, companies are also prioritizing strengthening blockchain risk management strategies to identify and address vulnerabilities effectively. Investing in blockchain research and development is another critical approach, enabling organizations to stay ahead of emerging challenges and innovate their offerings. A concern is the economic downturns affecting blockchain investments, which poses a significant risk to funding and growth opportunities in the sector.

Companies also face the risk of increased competition in the blockchain sector, which could pressure market share and profit margins. The potential for technological disruptions further

complicates the landscape, as advancements or alternative solutions may challenge existing implementations.

Overall, these threats underscore the dynamic and challenging environment in which blockchain companies operate, necessitating strategic planning and adaptability to mitigate potential impacts. Reflect a comprehensive approach to addressing potential threats, positioning companies to navigate the complexities of BCT more effectively.

6 DISCUSSION AND LIMITATION

The findings from my research align with the study conducted by Treiblmaier and Špan (2022), which investigated the impact of blockchain on Slovenian SMEs. Both studies highlight the significant role that BCT plays in enhancing BMs by promoting transparency, improving customer trust, and streamlining processes. This work has shown that BCTs influence on the value proposition of Slovenian businesses is substantial, echoing Treiblmaier and Špan's findings that experienced blockchain users report positive impacts across multiple BM components, particularly with increased trust and direct stakeholder interactions.

BCTs role in enhancing communication channels was also evidenced by the majority of respondents indicating improved direct interactions and security in communications, a result comparable to the findings of the compared article, where blockchain was recognized for its ability to establish new channels and facilitate P2P networks. The similarities in the findings suggest that blockchain's contribution to boosting customer relationships and business processes is consistent across different company sizes and levels of blockchain experience.

However, there were also respondents in both studies who reported no significant changes to communication or value propositions, indicating that the benefits of blockchain are not uniformly realized and may depend on factors such as industry type, implementation strategies, or the specific use cases adopted. The absence of reported complications in communication processes further supports the argument that blockchain can effectively integrate without causing unnecessary operational complexity.

A key limitation of this study, similar to the one discussed by Treiblmaier and Špan (2022), is the relatively narrow focus on Slovenian SMEs. This geographic and industry-specific limitation constrains the generalizability of the results to broader contexts or other regions. Furthermore, the sample included businesses with varying degrees of blockchain experience, which introduces disparities in the depth and applicability of the insights provided. Companies with no BCT experience might have different perceptions or might be less likely to recognize potential benefits, thus affecting the overall outcomes.

The reliance on survey-based data also introduces the possibility of response bias, as respondents' understanding and attitudes toward BCT may differ significantly. This aligns with the observed differences in perception between BCT-experienced and inexperienced companies, as highlighted by Treiblmaier and Špan. The data collected represents subjective views, which may not fully capture the objective impact or economic benefits of BCT.

Future research should consider a more diversified sample to encompass businesses from various regions and industries, enabling broader generalizability. Additionally, adopting a longitudinal approach would provide valuable insights into the evolving impact of BCT on BMs over time, thereby addressing the limitation of assessing BCTs influence at a single point in its adoption lifecycle.

7 CONCLUSION

BCT has a promising potential to redefine how businesses operate, particularly within the Slovenian market. The research findings stress how blockchain is more than just a tool for improving efficiency; it is a transformative force that offers companies the opportunity to innovate, diversify, and stay competitive in a rapidly evolving digital landscape. By allowing transparency, enhancing security, and automating processes, blockchain provides organizations with the means to create entirely new BMs and revenue streams.

Companies in Slovenia have been able to capitalize on blockchain’s unique attributes to introduce services like tokenization, decentralized payment systems, and smart contracts. These innovations not only open doors to new markets but also enhance customer trust and loyalty through the secure, transparent handling of transactions. The adoption of blockchain has allowed businesses to offer premium services and products that cater to an increasingly tech-savvy and demanding customer base. This shift is particularly noticeable in industries such as finance, energy, and real estate, where decentralized solutions are making significant inroads.

Despite the many advantages, the transition to blockchain has not been without challenges. High initial investment costs and regulatory hurdles remain significant barriers for some companies, especially those developing their own blockchain infrastructure. Moreover, scalability issues and the need for stakeholder buy-in can complicate the integration process. Nonetheless, for companies that have successfully navigated these obstacles, the long-term benefits of blockchain, such as reduced operational costs, improved efficiency, and enhanced security, clearly outweigh the challenges.

Looking ahead, blockchain’s role in shaping BMs is likely to grow even further as more companies recognize its potential to drive innovation. As blockchain adoption increases, so too will the need for strategic partnerships and collaborative efforts to address the regulatory, technical, and financial challenges that come with implementing such a disruptive

technology. Further research into best practices and case studies will be invaluable in guiding businesses on how to integrate blockchain into their operations best.

Ultimately, blockchain offers Slovenian companies a powerful tool to future-proof their BMs, helping them to adapt to an increasingly digital and decentralized world. By embracing blockchain, companies not only stand to improve their current operations but also to position themselves as leaders in their respective industries, ready to meet the demands of tomorrow's market. The ongoing evolution of BCT and its application in various sectors will likely continue to shape the business landscape, offering companies both new challenges and unprecedented opportunities for growth and sustainability.

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APPENDIX

Appendix 1: Povzetek (Summary in Slovene language)

Blockchain tehnologija pomembno vpliva na poslovne modele slovenskih podjetij, saj prinaša večjo varnost, preglednost in učinkovitost. Z uporabo nespremenljivih zapisov blockchain zagotavlja verodostojnost podatkov in krepi zaupanje strank. Hkrati omogoča neposredne transakcije brez posrednikov, kar znižuje stroške in pospešuje poslovne procese.

Raziskava v slovenskih podjetjih, ki so implementirala blockchain tehnologijo, je pokazala, da ta tehnologija odpira nove poslovne priložnosti, zlasti v sektorjih, kot so finančne storitve, energetika in nepremičnine. Na podlagi analize sem pripravila SWOT pregled, ki poudarja ključne prednosti, slabosti, priložnosti in grožnje pri uporabi blockchain tehnologije za preoblikovanje poslovnih modelov.

Blockchain prinaša velik potencial za razvoj novih produktov in storitev, saj podjetjem omogoča inovacije ter optimizacijo obstoječih poslovnih procesov v različnih panogah.

Appendix 2: Online - Survey

Dear,

I am a student at the School of Economics and Business, University of Ljubljana, conducting research for my master's thesis. My study focuses on the "Impact of Blockchain Technology on Business Models in Slovenian Companies." This survey aims to gather insights and perspectives from professionals and businesses across various industries in Slovenia regarding the adoption and influence of blockchain technology.

Purpose of the Survey: The primary goal of this survey is to understand how blockchain technology is transforming business models in Slovenian companies. By analyzing the responses, I aim to identify the key areas where blockchain is making a significant impact, the challenges faced during its implementation, and the overall perception of its beneifits and drawbacks within the business community.

Confidentiality and Data Use: All responses will be kept strictly confidential and used solely for academic research purposes. The data collected will be anonymized to ensure the privacy of all participants. Your honest and thoughtful responses will contribute significantly to the understanding of blockchain technology's impact on BMs in Slovenia.

Participation: Your participation in this survey is entirely voluntary, but highly valued. The survey should take approximately 10-15 minutes to complete. If you have any questions or need further information, please feel free to contact me at Andonovskaivana92@gmail.com.

Thank you for your time and contribution to my research.

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1. Name of Company / Organization
2. Which industry does your company operate in?
3. How many employees does the company/organization have?
4. What was the revenue of the company in 2023? (Question is not obligatory)

    - < 50.000
    - 50.000 - 100.000
    - 100.000 - 250.000
    - 250.000-500.000
    - 500.000-1.000.000
    - more then 1.000.000

5. What was the reason for integrating blockchain in the operations?
6. How did you initially learn about blockchain’s potential for your business? Write your answer in 'Other' if multiple choice is not applicable

- Industry conferences
- Professional publications
- Peer recommendations
- Internal research
- Consultants or advisors

7. How long did the integration process take?

   - Less than 6 months
   - 6-12 months
   - 1-2 years
   - More than 2 years

8. Do you believe that blockchain will improve data integrity within your business processes?

   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly Disagree

9. What was the primary reason for adopting blockchain technology? You can add your additional comment in “Other"

   - Improve security
   - Increase transparency
   - Enhance efficiency
   - Reduce costs
   - Drive innovation
   - Other

10. Has your company adopted tokenization for any part of your business operations? If yes, what has been the primary focus? (Key Activities)

    - Yes, for real estate or physical assets
    - Yes, for digital assets (e.g., NFTs, intellectual property)
    - No, but we are planning to
    - No, and we don’t currently see its relevance

11. To what extent do you agree that blockchain can facilitate payments within your business?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

12. How has blockchain technology changed your business processes or operational workflows?
13. How has blockchain affected your customer interactions or the value you provide to customers? You can add your additional comment in “Other"

- Increased transparency and trust in transactions
- Offering new services lice secure digital identities
- Improved customer loyalty through enhaced security
- Faster and more efficient service delivery
- Better protection of customer data and privacy
- Other

14. Have you noticed any changes in customer satisfaction or engagement due to blockchain? You can add your additional comment in “Other"

- Improved customer satisfaction scores as they feel more secure
- Increased engagement among tech-savvy customers
- Positive feedback about the ease and transparency blockchain brings
- Customers appreciating faster and more reliable services
- Higher retention rates due to increased trust and security
- Other

15. In what ways has blockchain influenced your company’s revenue streams?

- Opened new revenue streams through innovative products and services
- Efficiency gains from blockchain have reduced operational costs
- Increased revenue through enhanced customer trust and loyalty
- Increased revenue by offering premium blockchain-based services
- Launched a new service to verify the authenticity of products.
- Other

16. In what ways has blockchain influenced your company’s cost structures?

- Reduced fraud-related costs, positively impacting the bottom line
- Lowered transaction fees by eliminating intermediaries
- Smart contracts have cut down on legal costs and administrative overhead
- Reduced transaction fees significantly by eliminating intermediaries

- Other

17. Has blockchain enabled new partnerships or collaborations with other businesses?
18. How has blockchain integrated into your broader business ecosystem? You can add your additional comment in “Other"

    - Become a core part of our IT infrastructure, connecting seamlessly with existing systems
    - Integrated to supply chain management, enhancing coordination and efficiency
    - Integrated with customer relationship management systems for holistic view
    - Used in financial transactions to improve speed and security
    - Enabd corss- departmental collaboration through shared data platforms
    - Other

19. How have you addressed issues related to blockchain adoption, such as regulatory compliance or technological barriers? You can add your additional comment in “Other"

    - Worked closely with regulation to ensure compiilance
    - Invested in a scalable blockchain platform
    - Conducted regular training sessions for stuff
    - Implemented a phased approach to gradually integare blockchain
    - Partnered with technology experts to overcome technical challenges
    - Other

20. Can you describe any specific applications of blockchain in your daily operations?
21. How important is blockchain in automating customer relationship management processes in your business?

    - Very Important
    - Important
    - Neutral
    - Not Important
    - Not Important at all

22. What future opportunities do you foresee with continued blockchain adoption?

    - Opportunites in new market segments
    - Increased efficiency through automation
    - Technological advancements and competition

- Tokenization of assets for new investment opportunites
- Rapid evolotuin requiring continues adaptation
- Simplified regulatory complinance
- Other

23. How has the implementation of blockchain technology changed your company's business model?
24. In what ways has blockchain technology impacted your company's ability to innovate and stay competitive in the market?
25. How do you envision the role of blockchain evolving in your business over the next few years? You can add your additional comment in "Other"

- Becoming more integrated into daily operations.
- Enabling new business models and services
- Enhancing collaboration across the industry
- Driving innovation and competitive advantage
- Increasingly central to our digital transformation strategy
- Other

26. What are the key strengths of your company that give you an advantage in the marketplace, especially with the adoption of blockchain technology? You can add your additional comment in "Other"

- Strong brand reputation enhanced by blockchain transparency
- Innovative blockchain-based product offerings
- Higly skilled workforce with blockchain expertise
- Strong customer relationships bolstered by blockchain security
- Efficient operational processes improved by blockcained automation
- Other

27. What challenges have you faced in implementing blockchain technology?

- Complex initial setup and integration
- Regulatory hurdles and compliance issues
- Scalability isses with high transaction volumes
- Resistance to change from employees or stakeholders
- High initial investment cost
- Other

28. To what extent has Blockchain technology enhanced the transparency and trust with your customer.

- Greatly enhanced transparency and efficiency

- Moderatly enhanced transparency and efficiency
- No noticeable impact on transparency and efficiency
- Reduced transparency and efficiency
- Not applicable / No expirance with blockchain

29. In what ways has Blockchain technology altered the communication channels within your business model?

- Facilitated direct interactions between stakeholders
- Improved security of communications
- No significant changes to communication channels
- Complicated communication processes
- Not applicable / No experience with Blockchain
- Other

30. How has Blockchain influenced the value proposition offered by your business?

- Significantly enhanced the value proposition through increased trust and transparency
- Moderately enhanced the value proposition
- No impact on the value proposition
- Detracted from the value proposition due to complexity or cost
- Not applicable / No experience with Blockchain

31. Which areas of your business consistently receive positive feedback from customers, particularly related to blockchain? You can add your additional comment in “Other"

- Enhanced security and transparency due to blockchain
- Improved product authenticity and traceability
- Faster and more reliable transactions using blockchain
- User-friendly blockchain applications
- Customized blockchain solutions for specific customer needs

32. In which areas do you think your competitors have an advantage over your company, particularly regarding blockchain technology? You can add your additional comment in “Other"

- More advanced blockchain solutions
- Better integration of blockchain with other technologies
- Greater market penetration with blockchain applications
- Superior customer engagement through blockchain platforms
- Stronger brand recognition in the blockchain space

33. How can your company leverage its strengths to take advantage of market opportunities, especially through blockchain? You can add your additional comment in “Other"

- Expanding blockchain product lines
- Entering new geographical markets with blockchain solutions
- Enhancing digital presence using blockchain technology
- Innovating based on customer feedback about blockchain
- Strengthening blockchain partnerships and collaborations

34. What opportunities do you see in the market that could help your company grow, particularly through the use of blockchain technology?
35. What future threats do you foresee with continued blockchain adoption?

- Increased cybersecurity risks and vulnerabilities
- Regulatory challenges and uncertainty
- High energy consumption and environmental impact
- Lack of standardization across platforms
- Potential for misuse in illegal activities
- Difficulty in integrating with existing systems

36. Which phase of the integration was the most challenging? You can add your additional comment in “Other"

- Initial Planning
- Pilot Testing
- Full Implementation
- Post-Implementation

37. What are the primary weaknesses or challenges your company currently faces with blockchain implementation? You can add your additional comment in “Other"

- Limited financial resources for blockchain projects
- Outdated technology infrastructure not fully compatible with blockchain
- High employee turnover in blockchain-related positions
- Inefficient processes in integrating blockchain with existing systems
- Limited market reach for blockchain-based products

38. What external threats could potentially harm your company's business, particularly in relation to blockchain technology? You can add your additional comment in "Other"

- Increased competition in the blockchain sector

- Economic downturns affecting blockchain investments
- Regulatory changes impacting blockchain use
- Technological disruptions challenging blockchain implementations
- Supply chain vulnerabilities despite blockchain integration

39. How is your company preparing to mitigate potential threats in the industry, especially those related to blockchain? You can add your additional comment in “Other"

- Diversifying blockchain-based product offerings
- Investing in blockchain research and development
- Strengthening blockchain risk management strategies
- Building stronger relationships with blockchain technology suppliers
- Enhancing blockchain cybersecurity measures
- Other

40. What was the most surprising benefit you encountered with blockchain?
41. Are you planning to expand your use of blockchain in the next 12 months?

- Yes
- No
- Not Sure

42. What are the key challenges you anticipate or have encountered with blockchain adoption?
43. How would you rate the overall success of the integration? You can add your additional comment in “Other"

- Very Successful
- Successful
- Moderately Successful
- Neutral
- Not Successful

44. How has the adoption of blockchain technology influenced your company's Return on Investment (RoI)?

- Significantly increased RoI
- Moderately increased RoI
- No noticeable impact on RoI
- Moderately decreased RoI
- Not sure / Too early to tell

45. Is there anything else you would like to add about your experience with blockchain?
46. Do you have any advice for other companies considering adopting blockchain technology?

Appendix 3: Analysis of respondend's opinion

Table: Name, Industry of Operation, Number of Employees, Revenue of the company in 2023

Name of Company / Organization	Industry of Operation	Number of Employees	Revenue of the company in 2023
STRAMIND	business consulting	1	< 50.000,
Blokiments	IT, Analytics	4	< 50.000,
Blockchain Lab:UM (University laboratory)	Education, public administration	8	/
AFLabs	IT	10-20	/
NiceHash	smart contracts, decentralized applications, and supply chain management	5	50.000 - 100.000
NAKA	Financial Services	85	100.000 - 250.000
Apillon	Web3 applications	25	/
Blocksquare	real estate industry	6	/
The Crypto App	cryptocurrency and blockchain industry	3	/
BC Vault	cryptocurrency and blockchain security industry	20	/
SunContract	energy industry	1	500.000- 1.000.000

Table: BCT affected your customer interactions or the value you provide to customers (Customer Satisfaction)

Response	Responses
Increased transparency and trust in transactions	81.82%
Offering new services lice secure digital identities	45.45%
Improved customer loyalty through enhaced security	27.27%
Faster and more efficient service delivery	63.64%
Better protection of customer data and privacy	72.73%
Other (The new solution we are developing will provide customers with all the mentioned values.)	9.09%
Other (We don't have customers yet, we are startup)	9.09%
Other(Blockchain allows us to explore innovative digital asset services such as NFTs, giving customers access to a whole new realm of opportunities)	9.09%

Table: Importance of blockchain in automating CRM processes in the business (Customer Satisfaction)

Response	Responses x	F	X*F
Very important	5	6	6
Important	4	1	2
Neutral	3	3	9
Not important	2	0	0
Not important at all	1	1	5
Total		11	44

$\bar{x} = 44/11 = 4$

Table: Extent of BCT enhancing the transparency and trust with customers (Customer Satisfaction)

Response	Responses x	F	X*F
Greatly enhanced transparency and efficiency	5	7	35
Moderately enhanced transparency and efficiency	4	2	8
No noticeable impact on transparency and efficiency	3	1	3
Reduced transparency and efficiency	2	0	2

Not applicable / No experience with Blockchain	1	1	1
Total		11	47

$\bar{x}$ = 47/11 = 4.27

Table: Future opportunities foreseen with continued blockchain adoption (Value Preposition)

Response	Responses
Opportunities in new market segments.	81.82%
Increased eficiency through automation	63.64%
Technological advancements and competition.	72.73%
Tokenization of assets for new investment opportunities	45.45%
Rapid evolution requiring continuous adaptation.	18.18%
Simplied regulatory compliance	36.36%

Table: Implementation of blockchain technology changing company's business model (Value Proposition)

Company	Response
STRAMIND	The business model will be changed.
Blokiments	It is our core model from the beginning
Blockchain Lab:UM (University laboratory)	It introduced new revenue streams and lower cost of some cloud solutions used before.
AFLabs	more research focused
NiceHash	/
NAKA	BT has fundamentally transformed our business model. We have shifted to a decentralized payment system that eliminates intermediaries, reduces transaction costs, and enhances transparency. By using blockchain, we've introduced innovative services like non-custodial payment cards and automated processes through smart contracts. This has allowed us to expand globally, offer more secure and efficient transactions, and provide scalable crypto payment solutions to both merchants and customers
Apillon	t's given us more transparency and better security, while cutting down on manual work through automation. Plus, we've opened up

	new possibilities like offering digital assets and other blockchain-based services that wouldn't have been possible before.
Blocksquare	By enabling real estate tokenization and fractional ownership
The Crypto App	allows us to provide transparent, decentralized data, which has enhanced both the security and efficiency of our platform
BC Vault	/
SunContract	Ability to innovate by enabling us to create new products and services, such as decentralized applications and smart contracts. It has also made our operations more efficient, reducing the need for intermediaries, which lowers costs and increases speed.

Table: Responses on BCT impacted the company's ability to innovate and stay competitive in the market (Value Proposition)

Company	Response
STRAMIND	For us, blockchain enables the introduction of new business models that would be impossible without this technology. Combined with AI, we will introduce unique and innovative services.
Blokiments	We have good use for blockchain data
Blockchain Lab:UM	Stay in touch with latest technological advancements and solutions.
AFLabs	more broader look at the market
NiceHash	Blockchain has been a game-changer for Hashnet when it comes to staying ahead in the market. It's given us the flexibility to innovate faster, especially with smart contracts and decentralized apps, which open up new service possibilities. We can now experiment with cutting-edge solutions while keeping costs down and efficiency up.
NAKA	Blockchain technology has significantly boosted our ability to innovate and stay competitive in the market. It has enabled us to offer cutting-edge products, such as decentralized payment solutions and non-custodial payment cards, which differentiate us from traditional financial services. Blockchain's security, transparency, and efficiency have allowed us to continuously evolve and meet the growing demand for decentralized finance. By automating processes and reducing costs, we've been able to stay ahead in an increasingly competitive space.

Apillon	Has greatly boosted our ability to innovate by enabling us to create new products, like digital assets and smart contracts, that we couldn't have offered before. It's also helped us stay competitive by improving efficiency and security, allowing us to operate faster and with more transparency.
Blocksquare	Has allowed us to continuously innovate by enabling real estate tokenization and fractional ownership, which keeps us ahead in the market
The Crypto App	Has been a key driver of innovation and has allowed us to stay competitive in the fast-paced cryptocurrency market.
BC Vault	Blockchain's secure infrastructure allows us to offer unmatched protection for digital assets, which is crucial for staying ahead in a security-focused industry.
SunContract	Blockchain has really helped us step up our game. It's allowed us to create new products like decentralized apps and tokenized assets, while making everything run more smoothly and cutting costs.

Table: Primary reason for adopting BCT (Value Proposition)

Response	Respondents
Improve security	36.36%
Increase transparency	45.45%
Enhance eciency	18.18%
Reduce costs	0
Drive innovation	45.45%
Other: development of a new innovative digital solution for the market	9.09%
Other: It is our core business from which we get the data	9.09%
Other: Primary goal is to bridge traditional and decentralized finance, offering crypto payment solutions for merchants and customers, on that way expanding our global footprint in the crypto econom	9.09%
Other: Blockchain also supports our goal of simplifying complex processes for developers and businesses, further solidifying its importance in our operations	9.09%
Other: was to tokenize real estate assets and provide fractional ownership opportunities.	9.09%

Table: Blockchain influenced the value proposition offered by your business (Value Proposition)

Response	Responses	F	X*F
Signicantly enhanced the value proposition through increased trust and transparency	5	9	45
Moderately enhanced the value proposition	4	2	8
No impact on the value proposition	3	0	0
Detracted from the value proposition due to complexity or cost	2	0	0
Not applicable / No experience with Blockchain	1	0	0
Total		11	53

$\bar{x}$ = 53/11 = 4.81

Table: Calculating the mean of Time duration of integration (Key Activities)

Response	Responses x	F	X*F
Less than 6 months	1	2	2
6-12 months	2	4	8
1-2 years	3	2	6
More than 2 years	4	3	12
Total		**11**	**28**

$\bar{x}$ = 28/11= 2.54

Table: Calculating the mean of BC improving data integrity within business processes (Key Activities)

Response	Agreement (X)	Respondents (F)	X*F
Strongly agree	5	8	48
Agree	4	2	8
Neutral	3	1	3
Disagree	2	0	0
Strongly Disagree	1	0	0
Total		**11**	**59**

$\bar{x}$ = 59/11 = 5.36

Table: Adopted tokenization for any part of the business operations (Key Activites)

Company	Response
NAKA	Yes, for digital assets (e.g., NFTs, intellectual property)
Apillon	Yes, for digital assets (e.g., NFTs, intellectual property)
Blocksquare	Yes, for real estate or physical assets
The Crypto App	No, and we don't currently see its relevance
BC Vault	No, and we don't currently see its relevance
SunContract	Yes, for digital assets (e.g., NFTs, intellectual property)

Table: Impact on business processes or operational workflows by BC (Key Activities)

Company	Response
STRAMIND	Not internally, as we are currently a one-person business, but with the partners we are developing our own AI and blockchain-based digital solution for the market
Blokiments	We are able to serve customers our product now
Blockchain Lab:UM (University laboratory)	Blockchain added some new technical components and roles within the processes and system, but removed the other ones and made them automated (or not necessary at all).
AFLabs	Larger network of partners, increased the business breadth
NiceHash	It has transformed our business processes by automating and decentralizing tasks that used to require heavy manual oversight. Data integrity? Handled. Security? Top-notch. We can verify transactions in real time, cutting out the middleman and reducing costs significantly. Smart contracts streamline agreements, making our operational workflows more efficient and reducing the risk of human error. Essentially, blockchain has made us faster, more transparent, and more secure—just the way we like it
NAKA	has transformed our business processes by decentralizing payment systems reducing reliance on intermediaries and increasing operational efficiency.

Apillon	Blockchain has really streamlined the way we work. It's brought more transparency and security to our processes, cutting out a lot of the manual work. Now, we can manage transactions faster and more efficiently. Plus, with tokenization, we're able to dive into digital assets like NFTs, which is a big shift for us
Blocksquare	Has transformed our business processes by enabling real estate tokenization and fractional ownership, making property investment more accessible and efficient.
The Crypto App	By enabling real-time tracking, improving security, and ensuring transparent management of cryptocurrency data.
BC Vault	has strengthened our operations by ensuring robust protection of digital assets and fostering greater trust in the storage process
SunContract	has transformed our business processes by enabling peer-to-peer energy trading without intermediaries

Table: Reason for integration (Key Activities)

Company	Response
STRAMIND	decentralized data, smart contracts, interoperability
Blokiments	Getting data from Blockchain and anaisyng it is our Core business.
Blockchain Lab:UM (University laboratory)	Automation of the processes, increase efficiency of business workflows ...
AFLabs	Security
NiceHash	Create decentralized, fast, and secure solution for businesses
NAKA	to offer decentralized financial services, eliminate intermediaries, and promote financial inclusion
Apillon	To simplify and streamline the development of decentralized applications (dApps) and Web3 products. By utilizing blockchain, we ensure security, transparency, and scalability, allowing developers to create solutions like NFTs and DeFi products efficiently.
Blocksquare	To tokenize real estate assets, making property investments more accessible and liquid. By using blockchain, we can offer fractional ownership, ensuring transparency, security, and efficiency in real estate transactions.
The Crypto App	We integrated blockchain to provide real-time cryptocurrency tracking, enhance data security, and offer transparent portfolio management.

BC Vault	To enhance the security and transparency of cryptocurrency storage and transactions
SunContract	We integrated blockchain into our operations to decentralize energy trading and eliminate the need for intermediaries

Table: Specific applications of blockchain in daily operations (Key Activities)

Company	Response
STRAMIND	We build specialized AI and blockchain-based solutions within an ecosystem that covers various areas of daily business operations.
Blokiments	We just use it to get token data
Blockchain Lab:UM (University laboratory)	Backbone of decentralized identity system (used for micro-credentials), supply-chain for food production
AFLabs	real world assets on blockchain
NiceHash	We leverage smart contracts to automate and streamline agreements, cutting down on paperwork and speeding up processes. Also ensures that all data is secure, tamper-proof, and transparent, which is essential for tracking transactions and verifying authenticity. We also use it for internal audits making sure every action is recorded and easily traceable.
NAKA	Blockchain is fundamental in our daily operations to decentralizing payment systems, enabling secure and transparent transactions. We use smart contracts to automate and streamline agreements, reducing manual oversight and eliminating intermediaries
Apillon	It acts as a secure and transparent platform for managing financial transactions, ensuring speed and security without intermediaries. We also utilize blockchain for digital asset management particularly with NFTs, and employ smart contracts to automate and streamline administrative tasks reducing overhead.
Blocksquare	Is applied daily to tokenize real estate assets, enabling fractional ownership and secure, transparent transactions. We use smart contracts to automate processes such as property management, reducing manual tasks and increasing efficiency.
The Crypto App	Blockchain is integral to our daily operations in several ways. It is used for real-time tracking of over 3,000 cryptocurrencies across multiple exchanges, ensuring that our users have access to the most up-to-date and transparent data.
BC Vault	By providing secure storage and management of private keys for cryptocurrencies

SunContract	blockchain is central to our daily operations by facilitating peer-to-peer energy trading

Table: Issues related to blockchain adoption (Key Resources)

Response	Responses
Worked closely with regulators to ensure compliance.	63.64%
Invested in a scalable blockchain platform.	45.45%
Conducted regular training sessions for staff.	27.27%
Implemented a phased approach to gradually integrate blockchain.	45.45%
Partnered with technology experts to overcome technical challenges.	81.82%

Table: Key challenges encountered with blockchain adoption (Key Resources)

Company	Responses
STRAMIND	The biggest challenge is getting traditional businesses or industry users to adopt blockchain solutions.
Blokiments	Learning the technology, people not trusting us
Blockchain Lab:UM (University laboratory)	User experience of the platforms, regulatory rules about blockchain/crypto payments
AFLabs	legal
NiceHash	Has been getting it to work with our older system a lot of them weren't designed with blockchain in mind, so that's been a bit of a headache. We've also run into scalability issues as we grow, and making sure it handles bigger transaction volumes hasn't been easy. Regulatory uncertainty is another big one, with rules changing all the time. Plus, we've had to spend a lot of time educating clients on how blockchain can actually benefit them, since it's still pretty new to a lot of industries.
NAKA	Regulatory hurdles, especially as the legal framework for cryptocurrencies evolves. We've also faced technical integration issues, where existing systems required substantial modification to work seamlessly with blockchain. Additionally, scalability concerns arise as transaction volumes increase, along with the high initial investment costs needed to implement blockchain solutions.
Apillon	Regulatory uncertainty, scaling issues, and complex integration with current systems. We've also had to deal with employee training and high initial costs
Blocksquare	Regulatory compliance and technical integration issues

The Crypto App	/
BC Vault	/
SunContract	The most surprising benefit we found with blockchain was how much it boosted transparency and trust with our clients. We didn't expect it to strengthen relationships this much, but the security and clarity it provides really reassured customers.

Table Overall success of the integration (Key Resources)

Response	Responses x	F	X*F
Very Successful	5	5	25
Successful	4	6	24
Moderately Successful	3	0	0
Neutral	2	0	0
Not Successful	1	0	0
Total		11	49

$\bar{x}$ = 49/11= 4.45

Table: Initial learning about blockchain's potential (Key Resources)

Response	Responses
Industry conferences	5
Professional publications	3
Peer recommendations	5
Internal research	8
Consultants or advisors	1
Training courses(other)	1
Through its transformative ability to tokenize real estate assets.	1

Table: Blockchain facilitating payments within business (Revenue Stream)

Agreements	Response	Responses	X*F
Strongly agree	5	7	35
Agree	4	4	16

Neutral	3	0	0
Disagree	2	0	0
Strongly disagree	1	0	0
Total		11	51

$\bar{x}$ = 51/11 = 4.43

Table: Blockchain influencing company's revenue stream (Revenue Stream)

Response	Responses
Opened new revenue streams through innovative products and services	81.82%
Efficiency gains from blockchain have reduced operational costs	63.64%
Increased revenue through enhanced customer trust and loyalty	45.45%
Increased revenue by offering premium blockchain-based services	36.36%
Launched a new service to verify the authenticity of products.	45.45%
Other(Blockchain certainly opens up new concepts and has also been the starting point for an innovative digital product currently under development. This will transform our existing range of services into new revenue streams, new business models, and new or expanded target groups and markets.)	9.09%
Other (decentralization and transparency blockchain offers have enabled us to explore new markets and business models)	9.09%

Table: Blockchain influencing company's cost structures (Cost Structure)

Response	Responses
Reduced fraud-related costs, positively impacting the bottom line	36.36%
Lowered transaction fees by eliminating intermediaries	54.55%
Smart contracts have cut down on legal costs and administrative overhead	45.45%
Reduced transaction fees significantly by eliminating intermediaries	54.55%
Other (Due to the development of our own solution, our costs have increased substantially.)	9.09%
Other (We have costs for nodes)	9.09%
Other (automation and transparency provided by blockchain have streamlined processes, further reducing unnecessary costs related to manual interventions)	9.09%

Table: BC in enabling new partnerships or collaborations with other businesses (Key Partnership)

Response	Responses
STRAMIND	yes
Blokiments	Yes
Blockchain Lab:UM (University laboratory)	Yes, mostly with other blockchain/web3 companies working in the similar sector.
AFLabs	Yes
NiceHash	Smart contracts make things smoother and faster, no middlemen needed. We're also working with tech innovators who want to use our blockchain to create new decentralized apps. In short, blockchain hasn't just enabled collaborations—it's made them way better.
NAKA	Yes, blockchain has enabled us to establish new partnerships and collaborations with businesses across various sectors
Apillon	Yes, has enabled new partnerships and collaborations for us with other businesses. Providing a secure and transparent platform, blockchain has made it easier to build trust and foster cooperation with various partners, especially in the Web3 and dApp development sectors.
Blocksquare	We've formed alliances with property owners, investors, and technology providers. These collaborations help us expand our reach and offer innovative real estate tokenization solutions, making property investments more accessible and liquid
The Crypto App	Yes, enabled new partnerships with other business and opened the door to potential partnership with firms focused on decentralized finance.
BC Vault	yes
SunContract	Yes, various. Specially in energy sector

Table: Blockchain integration into the broader business ecosystem (Key Partnership)

Response	Responses
Became a core part of our IT infrastructure	63.64%
Integrated with customer relationship management systems for a holistic view.	27.27%
Integral to supply chain management	27.27%
Used in financial transactions to improve speed and security.,	54.55%
Enabled cross-departmental collaboration through shared data platforms.	72.73%
Building an ecosystem is a must when starting to develop blockchain solutions. Yes, we are building our own global ecosystem.	9.09%

Table: BC technology changing the communication channels within the business model (Channel)

Response	Responses
Facilitated direct interactions between stakeholders	54.55%
Improved security of communications	27.27%
No significant changes to communication channels	36.36%
Complicated communication processes	0.00%
Not applicable / No experience with Blockchain	18.18%

Table: Businesses reciving positive feedback from customers, particularly related to blockchain (Strenght)

Response	Responses
Enhanced security and transparency due to blockchain	45.45%
Improved product authenticity and traceability	54.55%
Faster and more reliable transactions using blockchain	45.45%
User-friendly blockchain applications	63.64%
Customized blockchain solutions for specific customer needs	45.45%
We have good data, that was acompliment from people(other)	9.09%

Table: Competitor's advantage between companies, particularly regarding blockchain technology (Strenght)

Response	Responses
More advanced blockchain solutions	54.55%
Better integration of blockchain with other technologies	27.27%
Greater market penetration with blockchain applications	36.36%
Superior customer engagement through blockchain platforms	/
Stronger brand recognition in the blockchain space	18.18%

Table: Most surprising benefit encountered with blockchain (Strenght)

Company	Response
STRAMIND	Strong, very supportive blockchain community
Blokiments	Data is free and always acessible
Blockchain Lab:UM	The tools and rules are quite mature already in certain places
AFLabs	emerging market penetration
NiceHash	The biggest surprise with blockchain was how much it simplified everything. We knew it would boost security and transparency, but the way it sped up processes and cut out unnecessary steps was a total game-changer. It saved us a ton of time and effort in ways we didn't expect
NAKA	the level of transparency and security it provided. We expected improvements, but the ability to verify transactions in real time and ensure data integrity without manual oversight exceeded our expectations.
Apillon	Significant boost in operational efficiency
Blocksquare	Level of transparency and security it provided
The Crypto App	Enhanced transparency and trust it brought to our platform
BC Vault	unprecedented level of security and transparency it offered
SunContract	

Table: Key strengths of the company that give you an advantage in the marketplace, with the adoption of BC (Strength)

Response	Responses
Strong brand reputation enhanced by blockchain transparency	63.64%
Innovative blockchain-based product offerings	72.73%
Higly skilled workforce with blockchain expertise	72.73%
Strong customer relationships bolstered by blockchain security	54.55%
Efficient operational processes improved by blockcained automation	45.45%

Table: Challenges faced while implementing BC technology (Weakness)

Response	Responses
Complex initial setup and integration	63.64%
Regulatory hurdles and compliance issues	72.73%
Scalability issues with high transaction volumes	72.73%
Resistance to change from employees or stakeholders	27.27%
High initial investment costs	36.36%

Table: The most chalanging phases of BC integration (Weakness)

Response	Responses
Initial Planning	9.09%
Pilot Testing	0.00%
Full Implementation	81.82%
Post-Implementation	9.09%

Table: Primary weaknesses and challenges companies face with BC implementation (Weakness)

Response	Responses
Limited financial resources for blockchain projects	27.27%
Outdated technology infrastructure not fully compatible with blockchain	27.27%
High employee turnover in blockchain-related positions	36.36%
Inefficient processes in integrating blockchain with existing systems	63.64%
Limited market reach for blockchain-based products	81.82%
Other (We dont have enough workforce to implement all verry quicky, but we are getting there)	9.09%
other (Users' education about the technology)	9.09%

Table: The company leverage its strengths to take advantage of market opportunities, especially through blockchain (Opportunity)

Response	Responses
Expanding blockchain product lines	81.82%
Entering new geographical markets with blockchain solutions	36.36%
Enhancing digital presence using blockchain technology	45.45%
Innovating based on customer feedback about blockchain	81.82%
Strengthening blockchain partnerships and collaborations	72.73%

Table: Opportunities on the market that could help the company grow, particularly using blockchain technology (Opportunity)

Response	Responses
STRAMIND	Our solution has great potential among a large target group globally.
Blokiments	People will want to analyse data easly on blockchain more and more, so we are good in that, growing market.
Blockchain Lab:UM	Better digital ownership/sovereignty and power of the users when using the blockchain technology.
AFLabs	zero knowledge
NiceHash	We're seeing tons of growth opportunities with blockchain, especially in areas like finance, supply chain, and healthcare where security and transparency are key. DeFi and tokenization are opening up new ways for us to create innovative products. We're also looking to expand into new regions as more places adopt blockchain tech.
NAKA	We see opportunities to grow by expanding into new markets with blockchain-driven solutions, particularly in regions that are embracing decentralized finance. Additionally, we aim to innovate and launch new blockchain products based on evolving customer needs, while increasing collaborations with blockchain partners.
Apillon	/
Blocksquare	we see growth opportunities in expanding real estate tokenization to new markets, offering fractional ownership globally
The Crypto App	One of the biggest is expanding our premium offerings, such as advanced real-time tracking features and decentralized portfolio management tools
BC Vault	One major area is the expansion of secure multi-wallet functionalities and multi-signature support, which could attract a wider range of institutional users.
SunContract	Expanding into new markets like digital assets and tokenization. Blockchain can also help us offer faster, more secure services, which improves customer trust and satisfaction.

Table: Envisioning the role of blockchain evolving in the business over the next few years (Opportunity)

Response	Responses
Becoming more integrated into daily operations.	72.73%
Enabling new business models and services	100.00%
Enhancing collaboration across the industry	81.82%
Driving innovation and competitive advantage	54.55%
Increasingly central to our digital transformation strategy	45.45%
Other	0

Table: Changes in customer satisfaction or engagement due to BC (Opportunity)

Response	Responses
Improved customer satisfaction scores as they feel more secure	45.45%
Increased engagement among tech-savvy customers	81.81%
Positive feedback about the ease and transparency blockchain brings	81.81%
Customers appreciating faster and more reliable services	0
Higher retention rates due to increased trust and security	63.63%
For traditional businesses, blockchain is not easy to understand (at least not for our traditional clients). They require significant time and training. However, the new, younger generation of users is demanding blockchain-based solutions. Other	9.09%
No customers	9.09%
Customers are embracing the possibilities of digital assets like NFTs.	9.09%

Table: Expanding of BC use in the next 12 months (Opportunity)

Response	Responses
Yes	100.00%
No	0.00%
Not Sure	0.00%

Table: Future threats foreseen with continued blockchain adoption (Thread)

Response	Responses
Increased cybersecurity risks and vulnerabilities	63.64%
Regulatory challenges and uncertainty	81.82%
High energy consumption and environmental impact	45.45%
Lack of standardization across platforms	63.64%

Potential for misuse in illegal activities	54.55%
Difficulty in integrating with existing systems	36.36%

Table: External threats that potentially harm the business, particularly in relation to BC technology (Thread)

Response	Responses
Increased competition in the blockchain sector	45.45%
Economic downturns affecting blockchain investments	81.82%
Regulatory changes impacting blockchain use	81.82%
Technological disruptions challenging blockchain implementations	54.55%
Supply chain vulnerabilities despite blockchain integration	18.18%

Table: Company preparation to mitigate potential threats in the industry, especially those related to blockchain (Thread)

Response	Responses
Diversifying blockchain-based product offerings	45.45%
Investing in blockchain research and development	45.45%
Strengthening blockchain risk management strategies	63.64%
Building stronger relationships with blockchain technology suppliers	72.73%
Enhancing blockchain cybersecurity measures	27.27%
Other	

Table BC influencing company's revenue streams

Response	Responses
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Other (Blockchain certainly opens new concepts and has also been the starting point for an innovative digital product currently under development. This will transform our existing range of services into new revenue streams, new business models, and new or expanded target groups and markets.)	9.09%
Other (decentralization and transparency blockchain offers have enabled us to explore new markets and business models)	9.09%

Table: Additional comments on experience with blockchain

Company	Responses
STRAMIND	Not all processes and data need to be on the blockchain, nor is it always necessary. We need to determine what is important to put on the blockchain and what is not, and how to manage data that remains off the blockchain for various reasons. It's important to remember that these new solutions also integrate AI, the metaverse, and other technologies. Currently, this development is still very expensive. Companies need grants to adopt these new technologies, along with extensive training and consulting support.
Blokiments	We learned a lot and are quite good now, because we did not start with investment but in a free time
Blockchain Lab:UM	Very useful technology, but solves certain problems and not all
AFLabs	x
NiceHash	/
NAKA	.
Apillon	/
Blocksquare	It’s allowed us to innovate, making real estate more accessible through tokenization
The Crypto App	/
BC Vault	
SunContract	

Table: Advice for other companies considering adopting blockchain technology given by respondents

Company	Responses
STRAMIND	Starting to implement blockchain in a company is essential; otherwise, they risk being left behind by time. However, it's not necessary for them to develop the solutions themselves. They do need good advice on what solutions are available on the market, what to watch out for during implementation, what additional knowledge or personnel they need for effectively preparing a strategy, and for the introduction of new technologies, etc.
Blokiments	Good luck
Blockchain Lab:UM (University laboratory)	Investigate it deeply before integration, think outside of box
AFLabs	x
NiceHash	To start small and test it out in one area before going all in. Finding right people who know both the tech and business. Facing regulatory challenges and most importantly, keep everyone in the loop it makes the whole process a lot smoother
NAKA	Is to start by identifying the specific business processes that will benefit most from blockchain's transparency, security, and automation.
Apillon	/
Blocksquare	
The Crypto App	/
BC Vault	
SunContract	